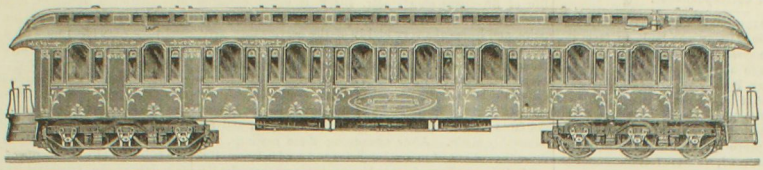
NATIONAL CAR AND LOCOMOTIVE BUILDER.



VOLUME XVII. NUMBER 3. | MARCH, 1886. | SINGLE NUMBERS, TEN CENTS. $1.00 PER ANNUM.

Miscellaneous Items.

THE Keith Mfg. Co., Sagamore, Mass., are building fifty box cars for the Old Colony road.

THE Union Pacific Railway Company carry their employés when off duty on special tickets at the rate of one cent a mile. The families of the men are admitted to the same privilege.

CONSIDERABLE interest has been manifested among Western railroad men in the working of the Leslie Rotary Snow Shovel, which has been operating on the worst snow-infested portion of the Chicago & Northwestern Railway during the winter. We heard a leading railroad manager express the opinion that it was one of the most extraordinary machines ever invented, in the perfect way the details were worked out without tentative experience.

MR. GEORGE T. HORTON, of Manitoba, has invented really a novel brake for cars. He proposes putting pulleys on the outside of car axles for braking purposes. This pulley he intends to embrace by a U-shaped spring set to close. Inside the spring he proposes to secure brake shoes which will press against the pulley when the spring is permitted to close. The mechanism of the brake will operate to keep the spring open till it is necessary to apply the brake, when the spring will be released.

THE Chicago & Northwestern Railway Company are having 1,000 freight cars built, and are equipping them with an automatic attachment to the Potter draw-bar. The officers of the road have not decided that this will prove a satisfactory safety coupler, but they believe that the experience gained by the cars to be equipped with the device will demonstrate its value or weakness. Several Thurmond couplers have been applied to freight cars belonging to the Chicago & Northwestern Railway, and their performance has been very satisfactory in every way.

MR. JACOB JOHANN has been connected with railroad machinery almost since the time they first began to build locomotives in America. He served his apprenticeship in the Norris Locomotive Works, at Philadelphia, but has been in the West a great many years. He is still as progressive as the youngest master mechanic in the country, and is constantly devising means for increasing the economical operation of railroad machinery. During the time he was in charge of a short road in Iowa, he reduced all the freight cars to standards, and found the changes could be more cheaply carried out than is generally supposed to be the case.

THE Dickson Manufacturing Co., of Scranton, Pa., is making a spring-plate steel-tired car wheel, which is attracting attention among railway officers. In this wheel the rolled-steel tire is joined to the cast hub by two curved steel plates so shaped as to compose an elastic resistance in every direction in which strains and blows affect it. It is claimed that the tensile strength and elasticity of the metal in these plates form complete security against their breaking, and that the crystallization of axles is largely removed by the spring of the curves, which counteracts the effects of the vibrations. This wheel has been in use since June, 1884, and is now running on some of the largest Eastern roads.

THE Cincinnati, New Orleans & Texas Railway Company had some curious snow experience this winter. Some cuttings on the road got filled with snow, and hard slipping was done by the locomotives in forcing through the obstruction. In one cutting a train got ditched by a broken rail shortly after the track was opened through the snow, and the wreck was hardly cleared away when a second wreck happened from the same cause. A close inspection of the rails was then instituted, and it was found that in some places depressions as much as $\frac{1}{16}$ of an inch deep were ground into the head of the rail, and in other places the surface of the head was torn by deep scratches that weakened the rail sufficiently to cause fracture.

THE severe weather of this winter has extended so far South that many roads have had to do snow "bucking" which formerly knew so little of frost that their locomotives were not provided with heaters to keep the feed-pipes from freezing. When the thermometer descends to the neighborhood of zero, and a heavy snow fall is being piled into mountain drifts by a furious wind storm, the best of engineers provided with the most approved facilities for defying cold have often hard work in preventing damage from frost; but the labor of keeping a locomotive going when no provision has been made for cold weather is stupendous. We have heard of considerable damage being done to railway machinery through frost, but less than might have been expected.

MR. JOHN BLACK, general master mechanic of the Cincinnati, Hamilton & Dayton Railroad, recently turned out of the shops, at Lima, O., a new locomotive of the company's eight-wheel standard type. The engine has cylinders 17 × 24 in., with wheel centers 56 in. diameter. The boiler is of the wagon top style, is 54 in diameter at smallest ring, and has 192 flues 2 in. outside diameter. The fire-box is 72 × 34 in. Boiler and fire-box are made of steel throughout, a single sheet being used for the outside shell of the fire-box. The inside crown is flat, and is supported by bars and sling-stays. A brick arch is used in the fire-box, and it is carried up as far as can be done without obstructing the draft enough to cause the flame to incline to pass out of the door instead of through the flues. An extension front is used, with netting, high nozzles and open stack. The guides and guide yokes are of cast-iron, and the slide valves are of the Allen pattern.

THE London *Railway Review*, which is devoted to the interests of railway servants, has lately been investigating safety appliances for railway operating. Among other things, it has been trying to find out how long a crank-axle will run safely. The conclusion come to was that 180,000 miles for a steel axle and 200,000 miles for an iron axle are about the outside limits of safe mileage. On the elevated railways of New York, where keeping within the limit of weight leads them to use rather light axles, and where a very close record of mileage is kept, they can tell within five thousand miles of when a steel axle will break, but they have never been able to determine the mileage an iron axle will make safely. If an iron axle stands half the mileage allowed for steel, it may be depended on to make double the mileage that a steel axle may be expected to break at. But, on the other hand, the iron axle is liable to break almost in the beginning of its service.

MANY railroad accidents that otherwise were not serious have been turned into terrible holocausts by stoves being overturned and scattering the fire about through the open door. Any invention that will reduce this danger must be regarded as valuable. We here illustrate a self-locking stove door latch, invented by Mr. G. T. Crandell, an employé of the Union Pacific Railroad, at Omaha, which appears to us to possess the merits of simplicity combined with efficiency. Fig. 1 is a perspective view of the latch, the peculiarity of which is, that it has two hinged wings which drop down by gravity and cannot be raised out of the catch unless closed by means of the rings attached to them. Fig. 2 is an end view of the latch, showing the wings down, and Fig. 3 shows the form of catch. Should a stove having this device be overturned, the latch could not get out of the catch, for the tendency would be for the wings to keep full open. Yet the latch will open freely enough when pulled on the rings by a hook, for that closes the wings.

THE New York Central Sleeping Car Co. will build 40 new cars for use on the West Shore road, and the contracts are now being let. Twenty cars now in use will be removed. In an interview with an *Inter-Ocean* reporter President Webb said that the new cars would be built according to a new pattern, which allowed the usual double berths with center aisles, but containing six state-rooms in the center of the car, with an aisle at the side of the car, thus breaking any draft. These six state-rooms will be so constructed as to allow of their being converted into three double rooms with four berths each. There will be two toilet rooms for ladies and three lavatories for gentlemen. Cars of this style will also be used on the New York Central's limited trains between Chicago and New York. Still another new style of car will be used on the morning run, between New York and Buffalo, of the Central's limited train, to be changed for a sleeping car at Buffalo. This will be a chair car, in the center of which or on one side will be two state-rooms for invalids or ladies desiring to travel alone.

AN agitation has been started in Iowa to make the office of Railroad Commissioner elective instead of being filled by appointment. Iowa has been noted for having particularly able railroad commissioners, men whose labors to effect justice and maintain harmony between railroad companies on the one hand, and the citizens of Iowa on the other, have been rewarded with eminent success. A change in the method of selecting these officers is almost certain to be a change for the worse. The peculiar qualifications that enable a man to maintain the interests of passengers and freight shippers while doing fairly toward railroad companies, are not likely to be possessed by a man who is deeply enough versed in political manipulations to steer a nomination and secure the votes that decide an election. So far the position of Railroad Commissioner in Iowa has entailed hard actual duties. It is most undesirable that a change should be made which would require these officers to devote more time to political fence mending than to laboring to have the people of Iowa treated fairly by the railroad companies.

The *Street Railway Gazette* thinks it is a strange and unnatural thing that the relations between the conductors and drivers of street cars should involve, as they almost invariably do, so much mutual confidence, sympathy and support, the conductor flying to the rescue of the driver and the driver to the assistance of the conductor when either gets into trouble with the company. To our mind there is nothing strange about it at all; but on the contrary quite the reverse. Conductor and driver are both in the same canoe, or car rather, and a fellow feeling makes them wondrous kind. And why not? The difference in point of dignity between their respective functions, as compared with the chasm which separates them both from the corporation which employs them, is as the difference between grains of sand and the rock of Gibraltar. Both conductors and drivers are, as a rule, overworked and underpaid, and as for either of them ever becoming so delirious as to "feel the dignity of his position," as the writer says the conductors ought to do, it seems to us that it would be quite as reasonable to expect a caravan of camels to go through the needle's eye. The idea of a man standing on his dignity who is handicapped with a bell-punch or a fare-dial clock to make him honest, his every movement meanwhile watched by spotters, is a ludicrous travesty of the moral fitness of things. This is the "process of reasoning" by which we account for the congenial relations existing between the conductors and drivers of street cars.

A Master Mechanic Injured.

Mr. G. W. Ettenger, whose promotion to the position of Master Mechanic of the Chesapeake & Ohio Railway, at Richmond, we commented on in the January number, was, we regret to say, dangerously injured in a collision that happened on the road February 2. A freight train was side-tracked to let an express train pass, and the brakeman neglected to close the switch. When the express train came along at a high rate of speed, it ran into the engine of the freight train, wrecking both engines. The fireman of the passenger engine was killed instantly, and the engineer was severely injured, while Mr. Ettenger, who was riding on that engine, had an arm and leg broken. From Mr. T. L. Chapman, Superintendent of Motive Power, we learn that the fractures are straight breaks, and located between the knee and hip, elbow and shoulder respectively, both about midway, so that with care there need not be any fear of permanent distortion o disability.

Automatic Freight Car Brakes.

The Master Car-Builders' Committee on Automatic Freight Car Brakes has sent to all the Railroad Commissioners in the United States the following

CIRCULAR.

The M. C. B. Committee on Automatic Freight Brakes has been endeavoring to bring about a competitive test of the different brakes that are being introduced. A joint meeting of the M. C. B. Committee and the representatives of different brakes was held at Harrisburg, Pa., Jan. 6. We inclose you a copy of the results of the meeting. From the interest manifested there seems to be now but little doubt that by April 1 the requisite number of entries will be made, and that a series of tests will take place at Burlington, Iowa, July 13, 1886. In this event our committee will invite the R. R. commissioners of the different States to be present.

We want to make these tests as thorough and complete as any that have yet been made. As there is considerable expense connected with such a trial, the tests ought to be carefully and thoroughly worked out. If properly conducted, there is no reason why the results should not become a permanent reference for all interested in this feature of freight train service. With this in view, we would be glad of any suggestions of features of freight train brakes that in your Board's opinion should be brought out during the trials. We can receive communications up to April 1, 1886.

GODFREY W. RHODES, Chairman.

SHOP NOTES.

Editorial Correspondence.

CHICAGO & ATLANTIC RAILWAY SHOPS, HUNTINGTON, IND.

The Chicago & Atlantic Railway was built to form the western link of the Erie system, and it makes nearly a bee line between Chicago and Marion, O., the western terminus of the New York, Pennsylvania & Ohio Railway. The strained relations that now exist between the Erie and the Chicago & Atlantic management have placed the latter road in an embarrassing position, yet it ought to be a very valuable railroad property. In the course of a trip we recently made over the road, we were fortunate enough to travel in company with Mr. David Sloan, chief engineer of the road, who gave us many interesting particulars about the line. It is built in first-class shape throughout, and the purpose followed, during location and construction, was to make a road that could handle a large body of traffic cheaply. The track was laid with heavy steel on hardwood ties, and ballasted with the best gravel that could be procured. There are no curves on the road that add materially to the resistance of trains, three degrees being the sharpest, and the heaviest grades are 26 feet to the mile, and short at that. With such a track the locomotives can pull very long trains with small expenditure of fuel.

The country traversed by the road is heavily wooded with much fine hardwood timber that is being rapidly cut down. All through the route, fine farms are taking the place of the timber land.

The mechanical headquarters of the road are located at Huntington, 142 miles from Chicago, and a little more than half way to Marion. This divides the road into two rather long divisions very convenient to operate, since it keeps all the rolling stock running into the shops.

Mr. Jacob Johann, the well known master mechanic, recently took charge of the mechanical department of this road, and he is laboring hard to get the rolling stock into first-class condition. His work is done under great difficulties. When the company were building, they finished up the track in the best manner, but they did not get the same done for the mechanical department. They began with a good machine shop, but the building is located in a marsh, and its foundation is so low down that ground can not be built up around it. As all the machinery was new when the road was opened four years ago, it was not considered necessary to supply an equipment of machine tools, and the shop is still nearly empty. The surprise is that the rolling stock can be kept going with the few tools and men at work, yet it appears to be in respectable condition. Mr. Johann takes a train of passenger cars into the machine shop, and gives them an overhauling and paints them, then keeps the same cars running together, so that the trains look uniform. He has several engines undergoing light repairs. All the locomotives are of Brooks' make. It is fortunate for a road that can get down to one make of engines, as the reduction in expense of repairs becomes an important saving. The water supplied at some parts of the Chicago & Atlantic road contains so much sediment that locomotives can not be run more than a year till the flues must be removed. At the end of that time about a ton of mud and scale will be taken out of the boiler.

All the engines had the diamond stack, but those running in passenger service have now been equipped with the open stack and netting in smoke-box or the Smith spark arrester. They are experimenting with different forms of exhaust nozzles, and intend to find out what draft appliances can be used to the best advantage while preventing spark throwing. Mr. Johann is ably assisted in his work by Mr. Brook, general foreman, who, besides being a good mechanic, is a graduate of a St. Louis technical school.

Mr. Wade, the foreman of the car shops that do not exist yet, is effecting heavy repairs in a small shed on a Pullman sleeper that got damaged in an accident. Almost any kind of a foreman can get out work when he has every facility of skilled men and tools at his command; but very great credit is due the foreman who produces excellent work with neither tools nor housing, and with very few men, as Mr. Wade is doing. Although it was the intention to keep the rolling stock of this road uniform as far as possible, the freight cars purchased have three or four different dimensions of draft timbers. Mr. Johann is determined to have them uniform, so the same draw-bar can be used interchangeably.

CINCINNATI, HAMILTON & DAYTON RAILROAD SHOPS.

A run of 75 miles east from Huntington, Ind., takes us to Lima, O., which is enjoying an excitement over the discovery of oil wells within the town. The enjoyment is by no means unmixed, for the oil smells so villainously that people troubled with sensitive olfactory nerves must suffer torture.

The leading attraction for the NATIONAL CAR AND LOCOMOTIVE BUILDER, at Lima, was not oil, however, but the principal machine shops of the road, presided over by our friend, Mr. John Black. The shops are not of modern design, and, like nearly all railroad shops, are overcrowded, yet first-class work is turned out very economically. They have just finished building a new locomotive, and have five in the shop for repairs, some of them getting new fire-boxes and other heavy work done. They calculate to put in a new fire-box every month. There is some very bad water on the road, which makes the life of fire-boxes short. Mr. Black is using cast-iron guides and guide yokes on all the locomotives that he repairs, and he speaks very highly of the service they give. We examined an engine that had been running on hard passenger service for two years, and the guides had not been closed, yet they looked as if the engine was newly out of the shop. The cross-head was cast iron without Babbitt or gib. The castings used in these shops are all got from the Bass Wheel Foundry, Fort Wayne, and are admirably made. After examining these castings, and those turned out of many foundries and used in locomotive work, it is easy to understand how other master mechanics have experience so different from Mr. Black with cast-iron guides and cross-heads.

There has been considerable trouble on this road lately, with tires wearing down rapidly, and Mr. Black believes some of the makers are turning out the steel too soft. We saw a turning about 35 feet long, $\frac{1}{16}$ inch deep and $\frac{3}{4}$ inch wide, that was preserved as a specimen cut from a tire. It is exceedingly soft metal that admits of a turning of that length holding together.

They have been experimenting with the counterbalancing of driving wheels, and have found that their passenger engines run much steadier by having more weight than the Clark formula for locomotive drivers calls for.

For all truck brasses they use a lining of antimonial metal, which performs functions similar to lead lining. The brasses are cleaned after coming out of the sand, then the antimonial metal is run on under a mold. This kind of bearing is used for engine trucks as well as tender and car journals. They are very highly spoken of. For driving boxes they use a half-round brass, and the practice is to relieve it about $\frac{1}{4}$ inch deep at the crown edges that otherwise would rest on the journal. They find this plan makes the brass wear longer without pounding. Mr. John Black, Jr., general foreman of the shops, takes an intelligent interest in finding out means of increasing the durability of locomotive parts.

Mr. Black is fortunate in having an intelligent and ingenious mechanic as foreman in the blacksmith shop, and this man, Mr. William Connair, has devised a great many formers and labor-saving devices for use in the shop. A triumph of ingenuity in this way is a machine for bending and welding car coupling links. It is an attachment of the steam hammer, and operates to scarf the ends and weld them at the same blow. The inventor was anxious that railroad men should know that his invention is considerably ahead of a device got out at the Big Four shops to do similar work, but which scarfs the ends at one operation and welds them in another, giving the iron a chance to fall below a welding heat.

Mr. Nash, the master car-builder, is not doing much except on repairs of freight cars. The principal part of the car work of this road is done in the shops at Cincinnati. They have recently built a novel form of simple wrecking car here. It is a flat car with an upright pillar at each end, to which a boom can be connected for handling wreckage. The pillars have sheaves let into them at the bottom, which, by means of two sheaves in the boom through which a rope is passed, gives considerable lifting power.

Mr. Ralph E. State, draftsman for Mr. Black, is a very able young man, and is well known to the readers of engineering journals by his valuable contributions to mechanical literature.

LAKE ERIE & WESTERN RAILWAY SHOPS, AT LIMA, O.

Mr. Cooper, superintendent of equipment of this road, has very conveniently arranged shops of recent build. He has only two locomotives in the shop, one undergoing a through repair, the other getting the damage repaired that resulted from a broken driving axle. The axle, which was the back one, broke close to the wheel. It was iron, and had broken gradually about $1\frac{1}{2}$ inch deep before finally parting.

In the car shops, two passenger coaches are undergoing heavy repairs, and there is a good deal of freight car work done outside. We were unfortunate in missing Mr. Cooper during our visit to his neat, well-kept shops.

ON THE ROAD TO INDIANAPOLIS.

From Lima we journeyed toward Indianapolis, first over a portion of the Cincinnati, Hamilton & Dayton road to Sidney, then by the Bee Line the remainder of the trip. The route led through a beautifully varied country of vale and woodland that reminds one of pleasant scenes in the English midland counties. The railroads in this region must make a good revenue from local freight and passenger business. The track of both the roads traversed was smooth, although the frost was coming out of the ground, and the cars were clean, well-ventilated and comfortably heated. The trains jog along about 25 or 30 miles an hour, which is about the most economical speed for railroad operating.

While passing over the Bee Line, we saw rather a striking example of how ordinary car seats suit the traveling public compared to chair seats. The first part of the journey was made in a car with ordinary seats, and as usual each of the passengers twisted himself over a whole seat, and did not seem to yield the half to another passenger, when required, in an amiable frame of mind. The travel was very fluctuating, and several times nearly all the seats had to be filled double, and there was considerable irritation apparent, especially among ladies. One lady had two double seats for herself when we started, and they were filled up with a bird cage and sundry small packages. She did not give up the second seat without words that were by no means sweet, but the vinegar came out still stronger when she had to admit a companion on the single seat. For some cause this car was taken off the train during the journey, and a reclining chair car substituted. Two chairs were secured side by side, and they did not occupy much more space than the ordinary seat. We watched the subsequent movements of the passengers closely, and found that none of them tried to appropriate two chairs, and there seemed to be no objection offered to other passengers taking their share of the sitting room. We believe for ordinary travel the railroad companies would find it an advantage to provide reclining chairs, although they could not crowd so many passengers into one car in an emergency. Putting seats of this kind into a car would slightly increase the dead weight per passenger, but, except in suburban travel, the full capacity of a car is never utilized, and cannot be without considerable friction.

PAN HANDLE SHOPS AT INDIANAPOLIS.

Not having been acquainted in Indianapolis, but knowing that our friend, Mr. Wm. Swanston, had got new shops to preside over, we ignorantly asked where the shops of the Chicago, St. Louis & Pittsburgh Railroad were. Indianapolis is given to calling its many railroads by pet names, and no one seemed to know what road was meant by the name given. Several men guessed there was no road of that name running into Indianapolis. If we meant the Vandalia Line, or the Big Four, or the Pan Handle, or the Bee Line and many others which we had never heard of before, they could direct us. After much perseverance we found what we wanted, but any stranger going to Indianapolis to inquire after railroad matters had better post himself on the local names of the roads before he starts out.

The shops belonging to the Jeffersonville, Madison & Indianapolis and the Indianapolis & Versailles divisions of the Chicago, St. Louis & Pittsburgh Railroad are located in the north suburbs of the city on a fine plot of elevated ground admirably adapted for dry, healthy shops. The shops are arranged on a detached building plan, each shop being reached by tracks without the aid of turn-tables or transfer-tables. Transfer-tables are not convenient, and where they can be avoided easily their absence is desirable; but it appears to us that it is possible to pay too dear for getting rid of them. In the case of these shops, curved tracks that, in some instances, ordinary locomotives can not traverse, are used to do away with transfers. We hardly think that a master mechanic would recommend his shops to be built after this plan, for it causes the distance between shops to be too great and multiplies the handling of material. Manufacturing firms that aim to make money out of their business do not spread their shops all over a township so that green trees and verdant lawns may intervene between the buildings. They want concentration. We believe if superintendents of motive power who are interested in getting their work done as cheaply as possible had control of the designing of new shops, the detached plan would soon go out of fashion on the Pennsylvania system.

Having introduced the subject with a growl, we will now notice the good features about these shops. All the buildings are of brick, substantially put up and furnished with first-class tools, and modern facilities of the most approved kinds are provided for handling work.

The offices and storerooms occupy a two-story building between the machine shop and roundhouse. They are very conveniently arranged. There is a fine dry basement where the heavier stores are kept, and part of the first and second floors are filled with a great variety of small material required in carrying on the work. Part of the second story is used as a drawing office. All operations of the office work are carried out in the systematic way for which these roads are noted. In the locomotive mileage office we noticed a method of arranging time tickets that was new to us. They have a folding case similar to cases seen in passenger tickets offices, with pigeon holes large enough to hold tickets for each engine. The holes are numbered, and the tickets belonging to each engine are thus kept separate and convenient for reference.

The machine shop is an oblong single story building very well lighted through side windows and the roof. They have a well-kept tool room provided with a full supply of standard small tools and templates. The machine tools in the machine shop are grouped along one side and the erecting stalls are at the other. In the center of the shop there is a raised platform on which the foreman has his desk, from which he can watch all parts of the shop. The main part of the shop is traversed by an overhead heavy traveling crane, and there are several pillar cranes at points where they can be used to the greatest advantage. Along the front of the stalls there are light traveling cranes for handling the heavier part of the erecting work. The machinery is driven by a Cummer engine, which is highly spoken of for the small attention it needs, and for the steady speed it maintains. They use a simple radial attachment to a large vertical milling machine for doing the work on links, quadrants and other parts that are a

segment of a true circle. Mr. Swanston speaks very highly of this attachment as a help in getting out accurate work. For cleaning scales off flues, they use the Otto flue cleaner made by the Flanders Machine Co., which gives entire satisfaction and saves the turmoil of a rattler.

The shop is full of engines undergoing repairs, and there are three or four jacked up in the roundhouse. There is one engine in the shop nineteen years old, which ran 123,000 miles without being off her wheels. She left the shop in May, 1884, and during the remainder of that year ran 31,506 miles at a cost for running repairs of $\frac{9}{10}$ of a cent per mile. During 1885, and the portion of this year she was kept running, the repairs cost $1\frac{4}{10}$ cents per mile, which included the cost of two pairs of truck wheels. The engine is light, with cylinders 16 × 24 in. and wheels 5 feet diameter.

The blacksmith shop is at the end of the machine shop, being part of the same building, and is a remarkably clean and orderly place. Like all other shops here, it is well provided with power tools. An unusual convenience for a blacksmith shop is a light overhead crane by which a heat can be transferred quickly from the furnace to the steam hammer.

In the car shop, Mr. E. Austin handles thirty light repair cars a day, besides doing considerable heavy repairs. He has a good shop and conveniently arranged planing mill, but like nearly all car shops there is too little room for the work done, and a great portion of the repairs has to be done outside. The machinery in the planing mill is so set that the work of one tool will not interfere with any of the others. They can run a sixty-foot sill right through without touching any machine but the one operating it. Mr. Swanston makes this locating of tools a matter of careful scheming. Mr. Austin got out a head lining rack that operates on the counterbalance system, and is found a great convenience in holding up the lining for painting and drying. They are going to put the Hutchins roof on fifty cars they are building. Several of these roofs were put on their cars two years ago, and have given such good service that they are disposed to try more of them.

There is a fire-proof building, apart from the others, used as an oil house. Cars are taken alongside this house and the oil casks landed on the upper floor, which is made of asphalt pavement. Through this pavement there are openings which connect with oil tanks below. Connections from all the tanks lead into the oil room, and gauge glasses show how much oil is in each tank. The oil is kept from freezing by steam pipes. The place is lighted at night by electric light.

The sand-dryer is an arrangement of steam pipes on top of the boiler used for supplying steam to heat the out buildings. The pipes form a flat radiator, and the ends are in direct communication with the boiler. The steam goes up at one end and the water of condensation drops down into the boiler at the other end. It is a very efficient and economical way of drying sand. By a series of experiments, Mr. Swanston found it took only fifty pounds of coal a day extra to keep the sand-dryer going.

Other notes about these shops we must defer. Before closing we would mention our sense of obligation to Mr. Swanston, his general foreman, Mr. W. C. Arp, and other assistants for kindness rendered.

INDIANAPOLIS, BLOOMINGTON & WESTERN SHOPS, AT INDIANAPOLIS.

The mechanical headquarters of this road are a section of a roundhouse and a few frame buildings scattered round it. The day we visited the place was rainy, and the frost was coming out of the ground. There was mud everywhere, and of unknown depth. They appeared to be busy and the general master mechanic was doing the greater part of the work. Mr. Hiserodt seems to be the kind of man who does not like to stand round looking on while his workmen are busy. His policy is to lead the way.

Having more stock cars than they need, and being short of box cars, they are changing the former into the latter by boarding the stock cars inside of the framing and hanging close doors on.

They expect to build fine new shops this season, and we never saw a road more in want of that improvement.

INDIANAPOLIS, DECATUR & SPRINGFIELD SHOPS, AT INDIANAPOLIS.

The shops belonging to this road are of the unusual character of being too large and commodious for the length of the road and the business done by it. They fortunately get considerable repairs to do for other roads, so that a fair force of men is kept at work. Mr. J. McKenna, the master mechanic, has just completed the rebuilding of an engine which got new driving wheels and new motion. They use roller balance valves on this road, and get satisfactory service out of them. They have some Grant engines that are deficient in weight on drivers, and are consequently very slippery. With these engines they are very successfully using a traction increaser invented by one of the engineers. The device consists of a lever fulcrumed to the draw-bar pin, and having the short end in a yoke fastened to deck plate of engine. The long end of the lever connects with a vacuum diaphragm fastened to the bottom of the tender. When the engineer wishes to use the traction increaser, he opens a small ejector and exhausts the air out of the diaphragm, when the lever pushes up on the front of the tender and down on the back end of the engine. It is a very simple rig.

They are using the Maloney spark arrester on some of the engines. It is the invention of their foreman boiler maker, and is a cast iron casing attached to the petticoat pipe with a cone for catching the sparks and projecting them into a receptacle placed on the front of the engine. An open stack is used with this device, and it is well spoken of as a spark arrester.

In the car shops they are making a set of reclining car-chairs. The frame is of black walnut, and a ratchet is placed under the arm by which the chair can be set at any position. The chair is a model of elegance and comfort.

INDIANAPOLIS CAR WORKS.

These works have been busy all winter on freight cars, and they have just begun work on one order for 500 box cars for the Chicago, Milwaukee & St. Paul road. The shops are frame buildings set in two parallel blocks, the preparing of material being done in one block and the erecting in the other. The works are not imposing in appearance, but they contain good tools, and the Superintendent, Mr. E. Cooper, has a systematic way of carrying on the work. The rough material comes in at one end, and during its operations toward finish is kept moving in the direction of the erecting shop. There is no more handling of material than is actually necessary. In the machine shop we found they used chilled iron lathe and boring mill cutting tools. They are reported to stand the work very well and save considerable expense for tool steel.

Master Car-Builders' Club.

The regular monthly meeting was held at the rooms of the Club, 113 Liberty street, New York, on Thursday evening, Feb. 18, the subjects for discussion being

CAR PAINTS AND CAR PAINTING, AND REPAIRS OF CARS BY CONTRACT.

Mr. J. Elmendorf said the primary coat was the most important one in all painting, and especially in the painting of cars. The wood should first be protected so as not to absorb moisture, and then the body should be worked up to the finishing coat of varnish, these two coats being necessary to protect the cars, while all other coats were merely for ornament. The whole wear of the paint, whether varnish or any thing else, was in the linseed oil; when that is gone the paint goes. The great trouble was with the dryer. He had tried to improve good raw linseed oil, but without success. All the patent oils and mixtures were a positive injury to good pigments when mixed with them. Paint seemed to dry all right, coat after coat, as it is put on, the car is sent out in splended order, but after a little begins to look dim, and after that it begins to flake. This was caused by the use of an inferior dryer, which evaporates and leaves nothing but the oil and pigment. Another cause of paint giving way was the use on the same cars of dryers, paints and varnish made by different manufacturers.

If the products of one maker are mixed with those of another, the result is bad. The best plan was to use the same dryer, pigment and varnish on a job all through, and not mix them. Genuine Tuscan red could not be bought for less than 50 cents a pound, yet a toned-up article can be had for 20 cents. The cheaper article, when put on a car, soon loses its original color, and a painter can't match it to save his life. Railroad companies, therefore, had cars of all shades, the result of trying to buy a gold dollar for 80 cents. It takes just as much labor, and a little more, to put on poor material as it does to put on that which is good. The best plan was to buy the purest ingredients, but the whole tendency now was to adulterate and cheapen. Adulteration was practiced to the extent of 60, 70 and 80 per cent. in the paints now sold.

Mr. L. Garey wanted to know how it would work to let a first-class manufacturer of paints paint the cars by contract, and be bound to keep them in good condition at a stipulated price.

Mr. Elmendorf replied that there would be the same difficulty as before. The lowest bidder would get the job, and the work would correspond with the price.

Mr. Keys had found it advantageous to put a certain quantity of hard gum with the linseed oil in the priming coat, and then work the surface up over that.

Mr. C. A. Smith asked whether paint could be made to adhere to paper panels on the outside of cars and retain its color; also whether such panels would have to be glued, as in old times, when burlaps were glued on the back of them to keep the dampness out.

Mr. Elmendorf believed that paper-board could be made with a mucilage under pressure, that would take linseed oil and be as lasting as any wood panel. There would be no grain and no chance for cracking, and the moisture could be kept out by a water-proof coating put on the inside of the panel before it was put on the car. Paper material was coming into vogue, and panels could soon be put in cars that would neither absorb moisture, expand, nor contract.

Mr. Garey thought that if the work could be done by contract, made for a length of time with good and responsible paint manufacturers, the cost to the railroads would be very much less than it now is. A better class of labor would be employed, and the expense of paint shop maintenance would be avoided.

Mr. Elmendorf admitted that if the contractors could be sure of having all the work of a great road for a series of years, say the Pennsylvania or the New York Central, it might be done very differently from the way it is now done for a lot of only fifty cars.

Mr. Keys said that if the cars could be called in for repainting as soon as they needed it, the cost of maintenance would be much less. But the cars, instead of being sent in when they merely need a coat of varnish, are kept in service until the old paint has to be burnt off, and then they have to be repainted and revarnished.

Mr. J. T. Leighton said that as he understood Mr. Garey's contract plan, it was that the proposed contractors should agree to keep a certain number of cars in good condition as respects the painting, for a term of years. If they did this, it would be policy for them to use first-class paint stock, and they would have to buy it of F. W. Devoe & Co., because that company are not contractors. This he believed would be a success, and he also believed the railroad companies would succeed with such a plan if they would. But they will not, simply because they want to buy cheap stock. Mr. Garey had said that the purchasing agents were responsible. This was not very far from the truth. The position of a purchasing agent depends upon his keeping up with "the other fellow," or, in other words, buying adulterated paints. He (Mr. Leighton) believed that a great deal of loss might be saved by making the contractor, the venders of paints, the painters and all concerned, interested in doing good work. He had had experience in the painting of cars. The men in the paint shop would adulterate stock in spite of all that could be done to prevent it. After being told to take the varnish right out of the can and put it on just as it was, they would slop in something to make it work easier under the brush.

Mr. H. A. Webster could not see why a railroad company could not buy as good and as cheap paints as a contractor, and get as good men to oversee and do the work. A great deal of the trouble now experienced in the painting of cars arises from the fact that a dryer is got from one party, the colors from another, and the varnish, perhaps, from two or three parties—a different party every month, perhaps. If there is any fault, one varnish man says it is caused by the other man's varnish, and the other man the other man's, and when they all get together, they say it was the painter.

Mr. Leighton suggested that the whole matter, when simmered down, involved the managers and directors as well as car-builders, purchasing agents and painters. The head officials are elected to govern the road and make money, and unless they can make a show of dividends they are not worth a stiver. They are cutting, and carving and scrimping here and there, and they are after the car-painter with the rest. It was pressure all the way from the head and front to the tail end.

Mr. J. M. Wade thought that the changes in the boards of managers of roads, which so frequently occur, would not be favorable to the contract system. A contract might be made under one set of managers that admitted of good material being used by first-class workmen, and the next set, in their eagerness to run the road as cheaply as possible, would interfere with the system and cut down the price. With respect to new work, the contract system might work well, but not as to repair work. The contractor could not afford to repair a single panel, for instance, at the same rate he would charge for a whole car.

As to the priming of panels, Mr. Wade spoke of the extremes of temperature to which some cars were subjected, one day at zero and the next 60° or 70° above. This was a severe test, and it was necessary to have paints and varnishes sufficiently elastic to endure it. If the paint was hard and brittle, and the varnish elastic, there was a lack of affinity, and the varnish would flake and crack. He had found that by using a compound consisting of equal parts of an elastic varnish and a hard drying varnish, good results were obtained. He also found good results by using a hardwood panel, thoroughly filling the pores and removing all appearance of the grain of the wood, then coating with a cement, and upon that laying a veneer of metal composed of lead foil and a certain amount of zinc to give it hardness. In England particular attention is paid to getting up the "body" for lasting effect and less to the varnish. Plenty of time was allowed between each coat of paint. He did not remember seeing paint burnt off any cars in England.

Mr. Wade exhibited some specimens of a new style of decorative panel-work applicable to railroad and street cars. By a combined mechanical and chemical process, perfect fac-similes of inlaid wood are produced, which are unaffected by moisture or heat. The work is done on three-ply wood, this being more convenient and less liable to crack or check.

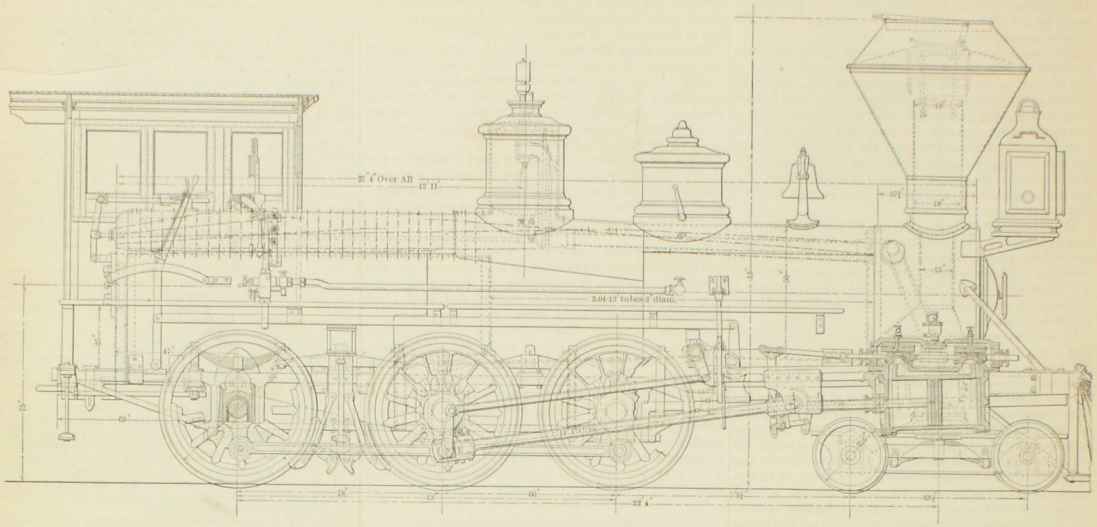
New England Railroad Club.

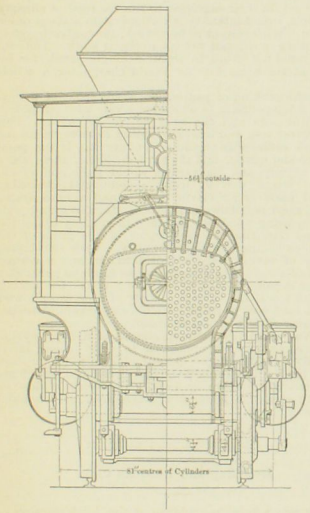
There was a large attendance at the joint meeting of the members of the Club and the members of the Boston Society of Civil Engineers, on Wednesday evening, Feb. 10, to discuss the "Relation between Rolling Stock and Roadway." The programme was a formidable one, the general subject being divided into fourteen parts, and each part subdivided into pairs, or twin topics, relating respectively to cars and track and the various conditions pertaining to each. It was hardly to be expected that each pair could be taken up in its order and disposed of in a single evening. Only two of the fourteen were discussed, the others being noticed only in an incidental way. These latter are to be taken up at some future time.

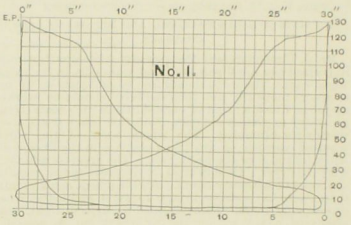
What was said related mostly to the gauge of wheels and track, the forms of wheel treads and flanges, the radius of rail-top corners, the amount of play needed on curves, etc. These topics have been talked about until they have become trite and threadbare, and as the present discussion developed nothing new, but consisted mostly of restatements of the complications and difficulties that have been so much dwelt upon, and with which our readers are perfectly familiar, we shall not occupy space by printing the proceedings in detail.

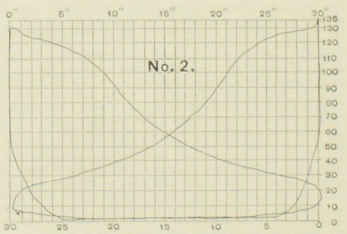
At the outset a resolution was offered declaring the present wheel gauge to be "unsatisfactory." The truth of this proposition was so obvious that the formal adoption of the resolution was not pressed. In the discussion which followed, the well-known theories as to the causes of sharp flanges were repeated, and a tabular statement presented showing the diverse wheel gauge practice upon New England roads. Upon these and sundry collateral topics there was much diversity of opinion, and the troublesome problems were left at the close of the meeting just as unsettled, if not more so, than they were at the beginning. The distance between backs of flanges seemed to be just as much an open question as if a standard distance had not been adopted by the Car-Builders' Association more than two years ago, and also a standard limit of variation last year, both standards having been approved by letter ballot.

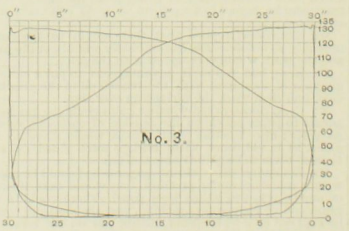
WOOD-BURNING LOCOMOTIVE—CENTRAL PACIFIC RAILROAD.

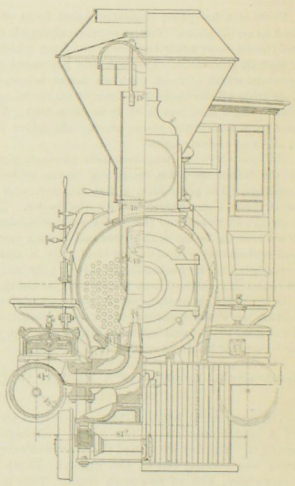












The engravings represent a wood-burning locomotive recently built at the Central Pacific Railroad shops, at Sacramento, by Mr. A. J. Stevens, general master mechanic of the road. In working order, the engine weighs a little over 50 tons, and is intended for the freight traffic on the mountain portions of the road, where there are many heavy grades. The cylinders are 18×30 in., and the driving wheels are 57 in. diameter outside of tires. By the well-known formula $\frac{d^2 \times s}{D}$ it will be found that the engine will exert a tractive force of 170 pounds for every pound of mean effective pressure in the cylinders. The engine is very well proportioned throughout, and as might be expected, is very successful in service.

The leading peculiarity about this locomotive is the valve motion, which was designed by Mr. Stevens several years ago, and was illustrated in detail in the NATIONAL CAR-BUILDER of July, 1883. At that time the motion had just been applied to the "El Gobernador," a huge locomotive built for work on the mountain grades. We see that Mr. Stevens has made changes in the arrangement of the motion since it was first brought out, practice in service, no doubt, having suggested changes. The motion is an adaptation of the Walschaert valve gear, and is planned to operate two valves for each cylinder. A sword-arm swinging on its longitudinal center is located inside the rocker-arm casting, and is not clearly seen in the cut. It is moved by a rock-arm connected with a return crank. A block, sweeping the sword-arm for the purpose of reversing the motion or shortening the valve travel, drives a radius bar which connects with a T-headed lever that performs functions akin to the wrist-plate of a Corliss engine. The valve rods connect with this lever, which receives part of its movement from the cross-head. The movement imparted to the valve gives very rapid opening and closing action, the valve remaining nearly stationary during the middle portion of the stroke. The valves of this engine have a supplementary passage through them similar to the Allen valve, but they are so arranged that steam is admitted doubly and exhausted doubly to and from the cylinders. In full gear with a valve travel of $4\frac{1}{4}$ in the port opening is $1\frac{5}{8}$ in., cut-off takes place at 26 in. of stroke, exhaust takes place at $29\frac{3}{4}$ in., and compression begins at $28\frac{3}{4}$ of the return. With a valve travel of $2\frac{1}{4}$ in. the port opening is $\frac{5}{8}$ in., cut-off takes place at 7 in., exhaust at 23 in. of stroke, and compression begins at $25\frac{1}{2}$. The admission lead is constant, but it will be seen that the exhaust lead increases as the engine is hooked up.

A few leading dimensions of the engine are, cylinders 18×30 in., size of steam ports $1\frac{5}{8} \times 14$ in., size of exhaust ports $3\frac{1}{2} \times 14$ in., outside lap of valves $1\frac{1}{4}$ in., exhaust clearance $\frac{3}{8}$ in., lead $\frac{1}{4}$ in. The grate area is 28 square feet, the heating surface of the fire-box is 161 square inches, and the heating surface of tubes 1,156 inches. The total weight of the engine is 101,850 pounds, with 72,800 on drivers.

The aim of the designer of this locomotive has been to produce an engine with large cylinders and a valve motion that will admit of heavy work being done while using the steam expansively. The motion admits the steam quickly at the beginning of the stroke, cuts it off at any desired point, and while cutting off early protracts the release as far as is consistent with avoiding injurious back pressure. The accompanying indicator diagrams show that the action of the steam in the cylinders closely approximates the distribution of steam obtained in automatic cut-off engines. The effect of this is apparent in the fuel record, for the engine is reported to do the same work with 25 per cent. less fuel than that used by link engines of the same size.

Shop Accounts.

The following is the principal part of the report made by Mr. W. H. Lewis, master mechanic of the New York, Chicago & St. Louis Railway shops, at Chicago, to Mr. John Mackenzie, superintendent of the motive power. The report gives a comparison of the work done and expense incurred in the years 1884 and 1885, and is highly creditable to all concerned. A striking peculiarity about these shops is the remarkably small quantity of stock carried all the time. An admirable system of card accounts, introduced by Mr. Mackenzie a few years ago, not only materially lessens the clerical labor of keeping store accounts, but enables the storekeeper to tell at any time exactly the quantity of material he has on hand. We will give in a future issue full particulars of this excellent system, which would save thousands of dollars annually to any road adopting it.

DEBITS.	1884. Amount.	1885. Amount.
To balance on hand first day of year	$29,937.47	$49,265.12
" amount of labor on pay rolls	201,112.65	187,702.35
" " " bills of supplies	134,421.14	100,679.02
" " " Comeaut shop	6,397.45	924.98
" " " material manufactured	31,749.70	40,473 61
Total	$403,488.41	$379,105.08
CREDITS.		
By amount of cost of Motive Power Department	$138,604.53	$125,257.33
By amount of cost of Maintenance of Cars	89,789.38	87,065.77
By amount of cost of construction and equipment	28,784.24	.....
By amount of cost of sundry accounts	97,045.14	110,837.04
By balance on hand at close of year	49,265.12	55,944.94
Total	$403,488.41	$379,105.08
SHOP ACCOUNT CREDITS IN DETAIL.		
Motive Power Department.		
Engine hostlers	$5,659.05	$4,949.36
Fuel and light, engine houses and machine shops	633.62	758.34
Repairs engine house and machine shops and turn-tables	2,675.54	3,891.43
Laborers and wipers	32,146.33	20,786.41
Oil, tallow and waste, passenger locomotives	720.99	820.55
Oil, tallow and waste, freight locomotives	8,269.19	7,085.11
Repairs passenger locomotives	3,817.23	10,731.53
" freight "	65,298.73	58,646.46
Furniture and fixtures, locomotives	2,629.71	3,128.11
Watchmen	1,132.20	1,071.34
Repairs tools and machinery	5,874.27	7,842.19
" fuel stations	549.02	130.95
" water stations and expenses of same	9,198.65	5,415.55
Total	$138,604.53	$125,257.33
Maintenance of Cars Department.		
Repairs, passenger cars	$16,134.05	$15,653.18
" freight "	71,812.41	65,985.81
" car shops and sheds	394.54	471.37
" tools	1,430.80	1,825.59
Laborers	.....	2,313.98
Watchmen	.....	651.35
Fuel and light, car shops	17.58	165.49
Total	$89,789.38	$87,065.77
Construction and equipment department	$28,784.24	.....
Average Balances.		
Average purchases new material per month	$11,724.05	$8,467.00
Average amount new material used per month	10,113.41	7,910.35
Average per cent. of new material purchased that was used per month	86.27	93.43
Average amount scrap on hand per month	4,769.99	5,785.66
Average amount old serviceable material on hand per month	6,770.04	5,879.51
Average amount new material on hand per month	36,448.55	41,180.51
Average amount new material received from the 22d day of each month to the 7th of following month, which is included in our monthly balances on hand last day of each month, but which, owing to lateness of arrival, cannot be used	2,030.80	6,350.25
Average net balance on hand of new material last day of each month	33,517.75	34,830.26
Furniture and Fixtures, Locomotives.		
A full equipment of tools and fixtures is maintained at standard at all times.		
Water Station Repairs.		
1 new boiler fire-box, 32 in. diam, 85 flues, 2 × 49 in., at Fort Wayne		$398.50
New floor pump-house, Fort Wayne		14.60
Framing new tank, Calumet		430.40
		$843.50

LOCOMOTIVE REPAIRS.

While the nature of the work done will not permit me to compare one year with another (except in a few instances) due to the dissimilarity of the conditions under which the repairs were made, I respectfully call your attention to the fact that more frequently renewals of worn-out parts were necessary in 1885 on account of the increased age of same. For example, cross heads, link motion, rod brasses and bolts, driving-box brasses and wedges, renewals of fire-box sheets, restaying and repairs of boilers are increased, together with the addition of parts of increased strength, when frequent failures of same have demonstrated a weakness, as in the cases of steam chests and eccentric straps, failures from these causes alone representing 50 per cent. of all failures due to defective machinery. The improvement in the general condition of locomotives and cars is very great, and the almost entire absence of delays to trains from any cause, and the very limited number of locomotives out of service for repairs attest their uniform good condition, and in appearance will compare favorably with the best.

	1884. No.	1884. Amount.	1885. No.	1885. Amount.
Rebuilt engines (cost exceeding $1,500)	5	$14,038.70	2	$3,629.32
Rebuilt engines, average cost	....	2,807.74	....	1,814.66
Rebuilt engines, No. days in shop	702	.....	96	.....
Rebuilt engines, average days in shop	140	.....	48	.....
General repairs (cost exceeding $500)	31	26,200.25	40	33,886.15
General repairs, average cost	....	845.17	....	847.40
General repairs, No. days in shop	1,517	.....	1,481	.....
General repairs, average days in shop	49	.....	37	.....
Light repairs (cost exceeding $100)	10	3,292.15	24	5,646.09
Light repairs, average cost	....	329.21	....	235.25
Light repairs, No. days in shop	216	.....	252	.....
Light repairs, average days in shop	22	.....	11	.....
Total number engines under these heads	46	43,531.10	66	43,171.53
Total number, average cost	....	946.33	....	654.11
Total number, No. days in shop	2,435	.....	1,839	.....
Total number, average days in shop	53	.....	28	.....
			1884.	1885.
No. engines on Western Division			58	58
Average per cent. of engines in service			90.03	93.41
COMPARATIVE WORK PERFORMED.				
Engines and tenders painted			44	53
" driving wheel tires turned			37	54
" truck " pair			6	42
" Flues changed			41	44
" steel tanks, tender frames and trucks complete			2	2
" iron tanks and frames rebuilt			6	4
" standard cabs			6	5
" " pilots			24	15
" " steel stacks			7	20
" cylinder lubricators			2	6
" driving wheel tires, pieces			1	4
" bells			4	1
" slabs in front of frames			22	28
" Monitor injectors			6	2
" No. 6 B Friedman injectors			7	2
" deck plates			6	9
" boiler lagging			20	22
" " jackets			3	2
" truck frames changed to standard			4	3
" frames repaired			2	2
" standard valves			19	19
" truck center and intermediate plates			19	21
" cabs rebuilt			.....	3
" cylinders, 19 × 24			2	.....
" " 17 × 14			2	.....
" " 16 × 22			.....	1
" paper wheels, 30 inch			.....	4
" crown bars renewed			21	23
" grate bars			8	18
" cylinder packing			24	15
" pop valves			3	1
" convey pipe			20	14
" crank pins			18	8
" spring balances			5	6
" steam gauges			5	4
" smoke box front complete			8	4
" running boards			5	15

RUNNING REPAIRS.

Engines repaired whose cost does not exceed $100 *at one time. All engines are given necessary repairs at termination of each trip.*

	1884.	1885.
Total cost of repairs to engines under this head	$25,584.86	$26,266.46
Total number pairs wheels and axles used under all engines	39	40
Total number pairs wheels and axles used under all tenders	199	193
MAINTENANCE OF CARS—PASSENGER AND BAGGAGE.		
First-class coaches, varnished outside	11	18
" " re-ornamented	9	11
" " painted	8	9
" " varnished inside	—	2
" " " oil finished	11	14
" " truck wheel tires turned	4	7
" " days in shop	593	688
" " average days in shop	54	38
" " total cost	$7,180.90	$8,686.34
" " average cost	652.81	482.58
Second-class " varnished outside	6	5
" " re-ornamented	6	4
" " painted	2	3
" " varnished inside	3	2
" " " oil finished	3	3
" " truck wheel tires turned	16	.....
" " days in shop	333	226
" " average days in shop	55	45
" " total cost	$2,385 31	$1,898.06
" " average cost	397.55	379.61
Baggage, varnished outside	3	4
" re-ornamented	3	4
" painted	3	4
" truck wheel tires turned	1	.....
" number days in shop	96	179
" average "	32	45
" total cost	$638.15	$1,086.61
" average cost	212.72	271.65
" rebuilt	....	1
" number days in shop	....	139
" cost	....	$877.59
Baggage, mail and express, varnished outside	4	5
Baggage, mail and express, re-ornamented	2	1
Baggage, mail and express, painted	2	1
Baggage, mail and express, truck wheel tires turned	12	3
Baggage, mail and express, days in shop	97	129
Baggage, mail and express, average days in shop	24	26
Baggage, mail and express, total cost	$1,010.80	$928.92
" " " average cost	252.70	185.78
RUNNING REPAIRS.		
Total cost of passenger equipment, while not in shop, for general repairs	$4,918.89	$2,175.66

Freight Cars.

	1884. No.	1884. Amount.	1885. No.	1885. Amount.
Box cars rebuilt or newly built	9	$2,720.34	35	$9,870.73
Stock cars rebuilt or newly built	2	737.00	4	1,019.05
Flat cars rebuilt or newly built	8	1,435.02	6	759.13
Refrigerator cars rebuilt or newly built	....	.....	2	246.45
Caboose cars rebuilt or newly built	2	1,130.80	1	261.60
Hand and push cars rebuilt or newly built	2	84.90	5	157.82
Total	23	$6,108.06	53	$12,314.78
Caboose cars painted	10	.....	18	.....
Box cars painted	68	.....	161	.....
Stock cars painted	7	.....	7	.....
Flat cars painted	27	.....	35	.....
Refrigerator cars painted	.....	.....	2	.....
Hand and push "	29	.....	47	.....
Gondola cars painted	2	.....	1	.....
Total	143	.....	271	.....
Freight cars turned out of shop, light repairs	14,191	.....	12,615	.....
Freight cars repaired on line by repairers	1,995	.....	2,267	.....
Total	16,186	.....	14,882	.....
Total cost	.....	$55,412.33	.....	$45,361.73
Average cost per car, light repairs	.....	3.42	.....	3.05
Total cost of destroyed, rebuilt and newly-built cars and all wheels and axles used	.....	16,400.08	.....	20,624.08
Pairs wheels and axles used (less cost of old)	786	7,891.75	1,076	8,216.25
Vouchers passed in favor of foreign companies for cars destroyed on this line, viz.:				
Box cars, bodies and trucks	1	411.14	.....	.....
Two tank line cars	2	577.35	.....	.....
Bodies of box cars	7	1,496.68	1	250.87
Average number employes per month	348	.....	331	.....
Average rate of pay per month	....	48.16	.....	47.27

From Train Boy to Mechanical Engineer.

Self-made men are so common in America, and particularly in railroad service, that the heroic efforts which a man makes successfully to push himself from the lowest to the upper ranks of life are seldom considered worthy of remark. Particulars of the lives of many leading railroad men would make a book of thrilling interest, and it is matter of regret that so little attention is paid to our "industrial biographies." To read of the persistent struggles that other youths have made is a great stimulant to contemporary youth to persevere in the self-help that leads upward, and grow not weary in well doing. In this connection it appears to us that some passages in the life of Mr. Samuel H. Harrington, mechanical engineer of the Chicago, St. Louis & Pittsburgh Railroad, are worthy of being related.

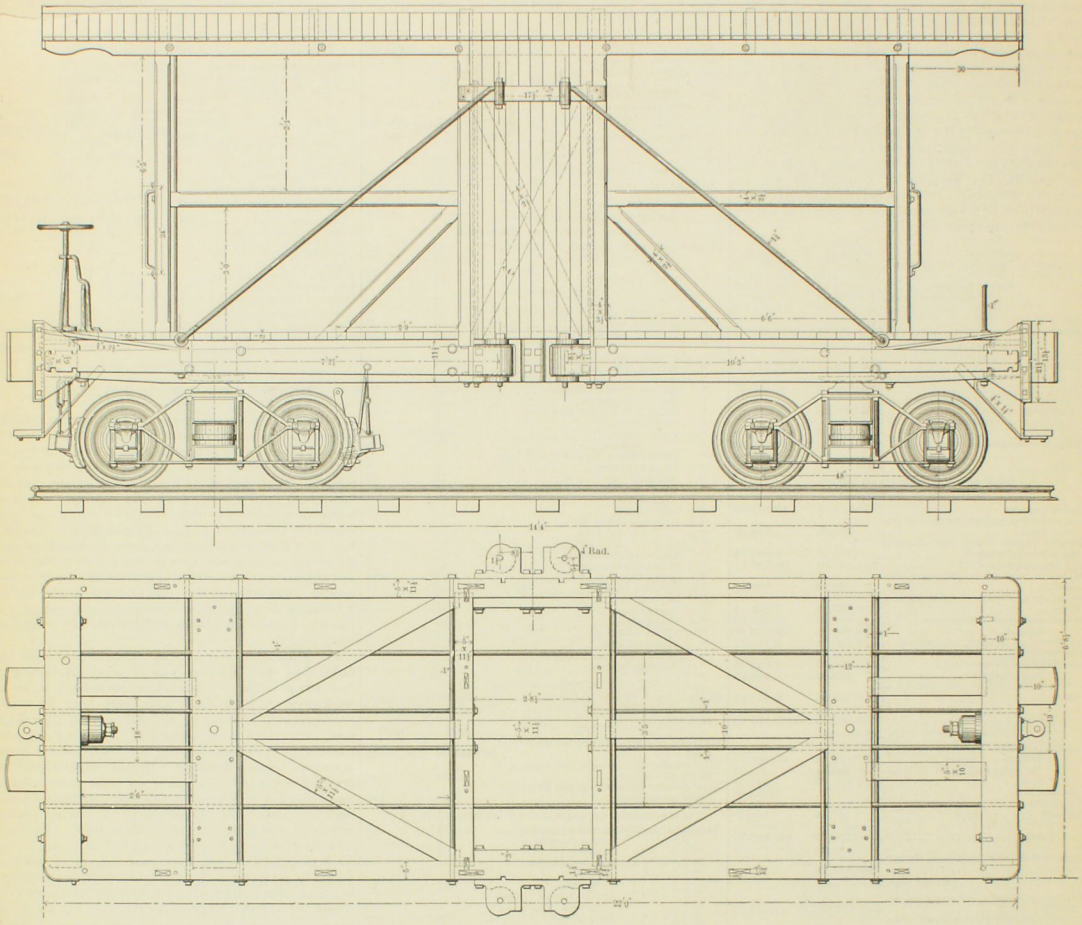
Mr. Harrington was born in Raltimore, Md., and his father died when the boy was 13 years old, leaving a family in poverty. It was necessary for Samuel to go to work at once, and like many other sharp boys, he found employment as train boy on the Baltimore & Ohio Railroad. After a few months, owing to his industry and good conduct, he was given charge of the confectionery stand at Camden station, Baltimore. He had a natural taste for drawing, and it became his most enjoyable recreation to make sketches of locomotives and cars, his principal drawing instruments being a paper-weight for making circles, and a common table knife for straight edge. Although his tools were poor, they were handled by nature's true workman, and did good work in the grasp of aptitude moved by persistence. The train men were soon attracted to the newsboy's drawings, and by most of them were considered wonderful achievements. One day while the boy was sketching, Mr. John L. Wilson, master of transportation, happened to see what he was doing, and became very much interested. Shortly afterward Mr. Wilson had Harrington placed in the drawing office of the road, at Mount Clare, and the boy was then fairly on his way to becoming a mechanical draughtsman. After he had been in the office some time, he met Mr. Wilson, who ever continued his friend, and was questioned as to his progress. He answered that he was getting on well with his drawing, but he was dissatisfied at not knowing all about the articles he had to delineate on paper. He wanted to work in the shops and get practical acquaintance with all operations done therein. This wish was granted, and he went through a course in the machine shop, blacksmith shop and foundry. After that he went to work in the drawing office again, with the satisfaction that his work was done understandingly.

That he might get an intimate and practical acquaintance with malleable iron castings, he left a good position in the Baltimore & Ohio mechanical offices and accepted rough work and less pay in the agricultural implement shop.

Mr. Harrington is now working steadily upward, and is a valued assistant to Mr. E. B. Wall, who is reputed to have great discernment in selecting help. He has designed a great many valuable special appliances for signals, and is now constantly occupied in originating devices for improving the company's machinery.

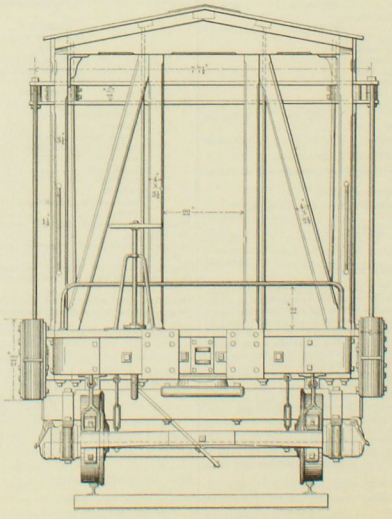
SINCE January 4, New York Central sleeping cars have been running on all through trains over the Grand Trunk and Western roads, via Buffalo, in place of Pullman sleepers. The change is the result of the New York Central securing the control of the West Shore. The Grand Trunk would have been prevented from running through sleepers between Chicago and New York, via the West Shore, if it had refused to put New York Central sleepers on its line between Chicago and Buffalo. It will, however, continue to run Pullman sleepers in connection with the Erie, the same as heretofore, as well as over its lines from Chicago to Montreal and Portland, Me.

COAL CAR RAM—LEHIGH VALLEY RAILROAD.



THE design of the car represented in the cuts is to facilitate the making up of coal trains in large track yards, like the one at Packerton, Pa., on the above-named road. By means of this ram car, an engine is able to set off cars on two tracks parallel with the one on which the engine is working, thus saving much time and labor in handling.

The car consists of a stout frame or body mounted on two 4-wheel trucks, and having arms upon each side which swing out far enough to reach the cars upon the two adjacent tracks. The floor frame has two side sills extending the whole length of the car. These are the only through timbers. Behind the buffer-blocks a pair of timbers extend back to the transom, which is a heavy stick 12 inches wide by 11½ deep, forming a part of the frame and flush with it. From the transom, two diagonals pass directly to the side sills at the point where the arms are attached. The outward thrust of these braces or diagonals is taken up by two 1-inch cross rods. At this point there are two cross timbers against which the diagonals take v bearing. A single line of short timbers is carried down the center of the frame between the transoms. The whole frame is made 11½ inches deep, except at the end sills and the timbers behind the buffer-blocks, which are 10 inches. There are four longitudinal rods tying the under sills to the central cross timbers, and two rods going the whole length of the frame outside of the buffer-blocks. Upon the frame a light open house with a roof is erected. This gives a cover for the men and a support for the stay-rods running to the outer end of the rams. There are four rams, two on each side. They consist of tapered timbers a little more than 8 inches wide at the point of connection with the car, and tapering to 5¾ at the outer ends. The ends carry a pair of round-faced castings bolted together and let into the timbers, as shown in the elevation. The hinges on which the rams turn are castings let into the side sills and bolted fast with four bolts each. The hinges at the top of the stays, or braces, are connected by a pair of flat iron bars. The remaining details are so clearly shown as to need no description.



Four-Cylinder Locomotives for Increased Tractive Power.

BY EDWARD E. R. TRATMAN.

Since the early days of locomotives, various devices have from time to time been brought forward to increase the tractive power of these engines by means of additional steam cylinders, and some of the methods have been put into practical use with more or less success, but as a class they have not been found to satisfactorily perform the work required of them. The method in which this increased power is sought to be applied is by increasing the number of wheels to which the steam power is transmitted, thereby increasing the amount of adhesion. In the more primitive days of railroads, when six-wheeled engines were the general type, this presented rather more difficulty than at the present time, but although there are now "Decapod" engines in use on lines with sharp curves and steep grades—the necessary play being obtained by placing "blind," or flangeless, tires on some of the coupled wheels—the use of engines with duplicate sets of driving gear still obtains to some extent. Locomotives of this latter type may be divided into two classes, viz.: those in which the tender wheels are utilized for traction, and those in which the engine itself is carried upon separate sets of driving wheels.

Spon's *Dictionary of Engineering* mentions the following:

Verpilleux. First introduced in 1842. The engine and tender on his system were on separate frames, and were each carried on four-feet driving wheels, with a wheel-base of five feet six inches. Each frame had a pair of outside cylinders. It was actually used on steep grades.

Czernuschi. This scheme, which was never put into practice, included secondary cylinders on the tender, and proposed to employ all the wheels of the train for tractive purposes by means of bevel gearing.

Sturrock. This celebrated locomotive engineer of the Great Northern Railway (England) built engines with six coupled wheels and a six-wheeled tender, the wheels of which were coupled together and driven by secondary cylinders. The frames were separate. The engine wheels were five feet, and the tender wheels four feet four inches in diameter. These engines were extensively used at one time with satisfactory results.

Flachat proposed to apply steam cylinders and driving gear to the tender and cars for the Alpine railway: the scheme was never carried out.

Fairlie. Steam tender similar to Sturrock's plan. Engine carried on six coupled wheels four feet in diameter arranged in a swiveling truck; and tender, separate frame, on four wheels of same size.

Maurice Urban. Grand Central Railway of Belgium. Inside cylinders. Engine and tender on separate frames, and each carried by six coupled wheels four feet in diameter. Secondary cylinders to tender.

Vuellemin. Eastern Railway of France. Steam cylinders and six wheels to both engine and tender.

The Northern Railway, of France, had an engine carried on two four-wheeled trucks, each with outside cylinders and mechanism.

A new method has recently been patented for this purpose, which, departing from the beaten paths of locomotive construction, presents some novel features which attract attention by reason of their boldness. The engine in question—as described in detail in the specification, though the principle is also shown as applied to various types of engines—is carried on six driving wheels, and the tender on the same, all of the same diameter; an ordinary four-wheeled truck is placed under the smoke-box and another under the foot-plate, these secondary trucks being pivoted in the usual way, but the center-pin, instead of being attached to a rigid frame, is attached to the driving-wheel truck-frame, which is itself pivoted at a center-bearing. Both engine and tender are carried upon one and the same rigid frame, but a marked peculiarity and divergence from previous methods is, that while the cylinders are attached to the main frame, the groups of wheels to which they impart motion are carried by a separate and swiveling frame; so that on curved portions of track the longitudinal axes of the cylinders and the truck frames are not parallel. In order to allow for the angle between the plane of motion of the crank-pin and the longitudinal axis of the piston-rod, consequent upon this arrangement, the strap-ends of the forward ends of the main connecting and tension rods are pivotally connected to the brasses, so as to allow of a horizontal vibration, while at the same time the brasses may be filed or keyed up without affecting this movement of the rods. An arrangement of a similar character is applied to the eccentric-rods for the same purpose. The piston-rod cross-heads are not connected directly to the crank-pins by connecting rods, but act through an intermediary system of levers, which not only allows of the swiveling of the truck-frames without interfering with the transmission of power, but also permits a "crank-pin stroke greater than that of the pistons, and consequently of a reduced piston speed relatively to a given speed of the driving-wheels." The cross-heads carry pivoted to them vertical rocking-levers, to the lower extremities of which are attached connecting rods leading to the crank-pins of the center pair of wheels, which they drive. The upper extremities are connected with the corresponding extremities of similar levers of equal size oscillating on journals in boxes attached to the main frame, and placed but a short distance from the cross-head levers, with the centers on the same horizontal axis as these. To the lower extremities of these secondary levers are attached tension-rods, which, at their other ends, are fastened to pins on the truck-frame, so that as the points of attachment to the truck-frame move back or forward, as the truck swivels on the curves, the forward end of the main connecting-rod is moved to a corresponding extent by means of the cross-head lever. The motion is transmitted to the other driving-wheels in the truck-frame by means of the ordinary coupling-rods. The description here given of the mechanism for the truck-frame under the engine, applies to the other frame under the tender, the two being precisely similar; the cylinders of the latter are bolted to a casting forming the foot-plate. The boiler is of the ordinary loco-tubular type, but the fire-box being between the two truck-frames is not cramped by the wheels, and can therefore be made as wide as the construction of the track will permit. The driving-wheels have the usual amount of vertical play in their boxes, and the weight is distributed over the axles by a system of levers connecting the pedestal of the center axle with the laminated springs placed over the axles. The truck frames carry the pilots and draw-gear. This is but a brief description of the engine chosen by the inventor for the illustration of the principles of his design, modifications of which principles are also suggested, and methods shown of applying the same to various classes of locomotives; but it is sufficient to give a fair idea of the salient points of the invention.

A locomotive of this construction does not belong strictly to either of the two classes referred to at the commencement of this article, for although the second set of driving gear is under the tender, yet that tender being carried on the same frame as the engine, the conditions are not to be considered the same as where it is carried upon a separate frame. There is one thing, however, which militates against the effectiveness of the duplicate gear upon tenders on separate frames, which applies to the above described engine in spite of the single rigid frame, and that is, the comparatively slight weight on the tender axles, so that with a heavy train on a steep grade very little extra useful adhesive power would be developed by these wheels.

In the "double boiler, double bogie" type of engine invented and successfully introduced by the late Mr. Robert Fairlie for the purpose of hauling heavy traffic over steep and winding roads, and so well-known by his name, the conditions are very different. In the "Fairlie" type—now used in all parts of the world—not only is an extended flexible wheel-base obtained with a minimum rigid wheel-base, but each truck carries the weight of an entire boiler and appurtenances, thus giving all the driving wheels an equal weight for adhesion. The engine has two ordinary locomotive boilers placed end to end, with a large divided fire-box between them, and the smoke-boxes at the outer ends; under each boiler is a truck-frame carrying the cylinders, motion, and driving wheels, the steam and exhaust pipes having flexible joints; the fire-boxes, which are fed at the side, can be of the full width between the main frames, and there is always—under proper conditions of water level in the boiler—a sufficient depth of water over the crown of the fire-box. The main difficulty experienced with these engines is said to have been the keeping tigh of the steam and exhaust pipe joints, and this I have been informed by a gentleman formerly in the locomotive department of the Cape Government Railways, was especially the case under the trying conditions of actual working on the rough lines of that system; but this is a matter of detail which should not be insurmountable, and is not a matter of principle.

In view of the loads hauled on roads with steep grades and sharp curves by engines of the ordinary construction, it does not seem likely that engines with duplicate gear will become general, but on roads where such engines are considered a necessity, it would, in the writer's opinion be cheaper in first cost and more economical in working, to adopt the Fairlie type of locomotive: with such an engine there is no complication of working gear, the two bogies having each its set of steam cylinders, valves, motion and mechanism complete, and each bogie has a weight on it sufficient to give powerful adhesion for tractive purposes. These engines, too, have had a wide and varied field of operations, with some very severe trials, and though in some quarters there has been considerable opposition and antagonism to them, it cannot be denied, in face of their extensive adoption throughout the world, that they have proved their capability for performing the heavy work assigned them.

The new type of engine herein described, has not been put into operation, and no comparisons therefore as to its working can as yet be drawn between it and the widely used "Fairlie" type; and though it may of course prove satisfactory, it seems to the writer that the connection between the rigidly fixed cylinder and the driving-wheels carried by a movable truck-frame, will prove a greater defect than the flexible pipe joint, and is, moreover, a matter of the principle of design of the engine, while the transmission of power through the levers seems likely to involve the absorption of a large proportion of the power. Further, while the mechanism for shifting the stub-end of the connecting-rod in accordance with the movement of the crank-pin, may act well on a line with strictly accurate and well laid curves and tangents, it seems probable that the swinging motion caused by the irregularities of road-bed and track, which would probably be numerous on such lines as this engine is intended for, would cause a considerable amount of wear and tear, and, what is more important still, an irregular working of the gear, causing severe strains upon the crank-pin and the entire mechanism.

As said before, however, there is as yet no working experience, and when an engine on this system is put on the track, its performance will doubtless be noted with interest by engineers and locomotive men.

Pioneer Locomotives.

Mr. George Escol Sellers, the well-known mechanical engineer, has been writing exceedingly interesting Early Engineering Reminiscences to the *American Machinist*. Mr. Sellers was one of the pioneer locomotive builders of America, and no man living is better able to give particulars of the growth of the locomotive. From a recent issue of that paper we clip the following paragraphs:

"The Chicago Exposition of Railway Appliances, in 1883, possessed great interest by the accumulation of early railroad appliances that were landmarks in the progress not only of railroad construction, but in all machinery pertaining thereto, particularly in the advance to the present perfection of both freight and passenger cars, and to the distinctive American locomotive. At the same time, to persons not familiar with the changes and alterations made from time to time in machinery as it is continued in use, and who are not able to detect or discover these changes, an exposition without note of the changed parts gives a false impression as to progress, and thus errors creep into and become fixed in history. I will cite an instance of this. An old and very interesting relic, a locomotive named "Pioneer No. 1," was on exhibition as the type of the Baldwin locomotive of 1836, with a certificate testifying that she was of that date; but no notice of changes or alterations having been made.

"This old engine, after its long use, was still in fair running order. The driving wheels, half-crank axle, dome boiler and inclined cylinders outside of the smoke-box, and the pump barrels as guides, were all the Baldwin engine of that period, but here all resemblance ceased; for the arrangement of the eccentric and valve gear, so essential to the working of the engine, were not Baldwin's of that date or any subsequent date. On seeing the old relic, it called to mind an engine of the same character that I had seen in the Michigan Central Railroad Shops, at Detroit, that had the valve gear changed in the same manner by Mr. Stephen Newhall, master mechanic of that road. My elder brother was with me when looking at the old Pioneer, and I called his attention to these changes and asked if he knew anything of the M. C. engine. Before he replied, a man whom I had noticed apparently critically examining the old engine, said to me, 'You are right, I worked for Newhall when this engine was altered. I took off the loose eccentrics, and if you will look under the foot-board, you will see some of the old attachments for shifting them.'

"It did not occur to me until after we had left the engine and lost sight of the man, that Mr. Baldwin, before this engine was built, had abandoned his loose shifting eccentrics and adopted a fixed single eccentric to each cylinder, with double-armrock-shaft under the foot-board, the forward or backward motion being given by alternately attaching the eccentric rods to either upper or lower arm of the rock-shaft by flat hook connections, the arms of the rock-shaft being brought into position to connect by hand levers.

"I have no recollection of the loose reversible eccentric on any of Mr. Baldwin's engines after his first engine built for the Philadelphia & Germantown Railroad. At all events, the "Lancaster," built for the State road, and, I think, the third of his build, was, as I have described above, single fast eccentrics and double-arm rock-shaft.

"When I commenced writing these reminiscences, to guard against errors of memory, knowing that my nephew, Morris Sellers, now of Chicago, had been on the Michigan Central, while Mr. Newhall was superintendent of motive power, I wrote asking if he had any recollection of the alterations made on the valve-gear of a Baldwin engine on that road, and if he could give me anything in regard to the early history of the Pioneer. With his reply he forwarded for my perusal (to be returned) a letter from the Baldwin works, in reply to inquiries of Mr. Geo. W. Felton, Superintendent of the Chicago and Northwest Railroad, as to the history of the old Pioneer, owned and in use by that company. They say:

"By referring to the order books, which contain the records of the locomotives built by us from 1836 to 1850, we are unable to identify this engine under the name given. Some years ago our Dr. Williams had occasion to investigate the history of the engine referred to. Inquiries concerning it having been directed to us at that time by Mr. John C. Gault, then with the Chicago, Milwaukee and St. Paul Railroad Company, his recollection is that the facts then developed showed the locomotive to have been built originally for the Utica and Schenectady Railroad in 1836; it was the 37th locomotive built by Baldwin, the founder of these works, and was tried on the 14th of July of that year.'

"My nephew in his letter says: 'The present management have little information as to when the Pioneer came on their line. In January, 1855, I went to work on the Michigan Central Railroad. Mr. Stephen Newhall, then superintendent of machinery, sent me to Michigan City, and the first job I did was to set the valves on the engine Swallow, a *fac-simile* of the engine Pioneer, with exactly the same motion shown on her at the exposition; the Michigan Central Railroad had two of these engines, the second being the Alert. This engine, at the time I name, was in the back shop at Detroit, being throughly overhauled, and, if my memory serves me, having her *loose eccentrics* removed for the hook motion I found on the Swallow.' At a later period, when he was running a gravel train at Chicago, he says: 'I remember the Alert came to Chicago, and was sent over the river to some western road, and as the old Galena road was the only road coming into Chicago on the north side, it must have

been to that line, which is now the Chicago and Northwest Railroad.'

"The inference is that the name Alert was changed to Pioneer No. 1, being probably the first construction engine on the railroad. Further on my nephew says: 'I am very certain that Mr. Newhall changed the motion of both these engines. Mr. Charles F. Jauriet, some time before his death, in speaking of these old engines, said he ran the Swallow on passenger trains, and that both engines came from York State, I presume Schenectady Railroad, although it is quite likely they were directly from Baldwin, as the road was running as early as 1838, at which time he was building engines of that class.'

"James Elkins, an old locomotive engineer, who has been with me many years, tells me that during the years 1847 and 1848 he ran a Hinkley & Drury engine on the Michigan Central Railroad; at that time Daniel Petty was Master Mechanic. That the road, when it belonged to the State, and before its sale to the Eastern Company, was equipped with the Baldwin engines, all of the six-wheel type, with *single eccentrics*; he has no recollection of any of them having the loose reversible eccentrics; this was before Mr. Newhall took charge; that all these first locomotives were then in efficient and active service.

"The Pioneer was a most interesting relic to me; the only regret being that the alterations that had been made on it had not been noted when put on exhibition as a type of engines of 1836.

"Here, at the Bowlesville coal mines, in southern Illinois, is another relic, a link in the progress of locomotives. It is a six-wheel Baldwin engine, one pair of 44-foot drivers and four-wheel truck. There is neither number nor date on this engine. It was purchased by the coal company of the Camden & Amboy Railroad about 1855 or '56. It was represented as having been built in 1840, and at the time of its sale was thoroughly overhauled before shipping; with it was also purchased an old English locomotive that has long since gone with old scrap metal. In 1870 I put new fire-box and flues in the old Baldwin engine, with such alterations as to adapt it to burn soft coal, it having previously been used with wood. After these changes the engine continued in regular service for about five years, and then occasionally until 1880, when the outer shell of the boiler was found to be unsafe, though all the working parts were in fair order. It was thrown out to the weather and gradually dismantled, as portions could be used in general repairs. Its actual active service may be fairly estimated as over 35 years.

"This old engine has the dome boiler, an iron frame of the simplest construction, straight flat bars of $1\frac{1}{8}'' \times 4''$ extending from back to front bumper, the jaws pedestals for the driving axle, cast iron bolted to these bars, the *driving* wheels are front of the fire-box, the same position as the Norris engine of 1834. They are outside connected, no outer frame, but in its place a rim-board from the cab to the front bumper, with hold on hand-rails lengthways on top of the boiler, that the fireman could safely clamber along and lubricate while the engine was running; cylinders, $10\frac{1}{4}'' \times 10''$ stroke. The barrel of the pump make a single guide-bar, a device peculiar to all the early Baldwin engines; the driving wheels are cast iron with both spokes and rims double flanged, with hubs apparently over 2' diameter into which the wrist pins are secured; but these hubs are hollow and internally arranged to *counterbalance* the crank portion; they are closed by a heavy iron plate securely bolted and riveted. The single eccentrics have two eccentrics to each cylinder; the flat hook connection to the rock-shafts still used, with hand lever socket-spindle rock-shaft back of the dome and over the fire door, that the runner could throw the rock-shaft arms in position and secure connection.

"Our struggle with the Pennsylvania Canal Commissioners to allow us to build for the State Railroad outside-connected engines, with iron frames, was in the fall and winter of 1834, the first engine being put on the railroad in 1835.

"The history of the Baldwin Locomotive Works, from 1831 to 1881, on the 17th page, we find:

"'On the one hundred and thirty-sixth locomotive, completed Oct. 18, 1839, for the Philadelphia, Germantown & Norristown Railroad, the old pattern of *wooden frame* was abandoned, and no outside frame whatever was employed; the machinery, as well as truck and pedestals of the driving-axles, being attached directly to the naked boiler. The wooden frame thenceforward disappeared gradually, and an *iron frame* took its place.' In the same year it was noted that he was building outside connected engines, 'and had succeeded in making them strong and durable.

"This is an evidence of the slow and guarded advance. It took four years of continuous service of *outside connected iron frame locomotives* on the State road before this justly celebrated builder adopted them, and now his biographer tells it in language from which any one would infer that it was original with him.

"The truck of this old relic is most ingenious; it comes as near as possible to accomplishing what was done by the center carrying truck that I have before described as possible, without adopting it. It may be said to have no frame, the axle boxes are firm without any play, being fixed to the bar that connects that of the front to the back axle; between these boxes, on the upper side of this bar, there is raised a massive cast iron boss or lobe, faced on both sides, through which is a transverse hole of about 3 inches diameter; in front of this is a vertical hole that passes through the connecting bar, of about 2 inches diameter; the plate springs are hung under and between the axle boxes, a rod or plunger passes through the vertical holes, the lower ends resting on the center of the springs, the upper end being considerably enlarged and slightly rounded against the under side of the engine frame, thus transmitting the weight of the front end of the engine on to the springs. The side boxes are connected, one pair with the other, by a shaft with deep collars that fit against the bosses and are drawn tight by keys on the ends that pass through the transverse holes; the center of this shaft is so shaped that the center pin of the engine passes through it and is free to play up or down, the stability of the truck depending on this shaft and the deep flanges on the wheel axles."

THE Wisconsin Central Railroad Company have begun what appears to be a reform in sleeping-car management. They run their own cars and provide good accommodation at a very low rate, but issue no passes. The porters are paid a living salary, and are prohibited from charging for the services they render to passengers.

Communications.

Relative Value of Steel and Iron for Boilers.

Editors Car and Locomotive Builder:

I beg to inclose you the article prepared for you on the above question, as well as that forwarded to me by Mr. Bouscaren. As I was going South at the time it was prepared, it was mislaid, and has just been exhumed.

* * * * * * * * * *

I am aware there has been considerable interest manifested in this problem by parties who are concerned in its solution, and can give you some data.

As the C. S. Ry. is very young, I cannot give you the full life of a steel fire-box, although all of our locomotives are equipped with that kind of material; in fact, I may say that the steel fire-boxes have not been in service long enough on any of our divisions to allow me to give you the completion of the life of any.

The oldest two engines owned by the C. S. Ry. have been in service seven years and four months without showing any sign of weakness in the fire-boxes; 54 other engines which entered service in quick succession thereafter on same division, show as yet no signs of weakness, and are doing very well.

I remember a case of a steel fire-box which was put in on a neighboring railway about ten or twelve years since, and was only in service a few months when it cracked with a loud report as the boiler washer was in the act of filling the boiler after having washed it.

I also recollect another case which came under my notice while connected with the L. C. & L. Ry Engine No. 33, equipped with a steel fire-box, showed symptoms of disease after three or four years' service, the steel becoming so hard that it was impossible to drill a hole through it. The box was removed, and during its removal a blow was struck on one of the side sheets, cracking it vertically up through the position of the stay-bolts.

At the time of which I speak the introduction of steel fire-boxes was virtually new, and I think a higher grade of steel was used than at present. The Otis Steel Co., of Cleveland, and the Schoenberger, of Pittsburgh, are now making a low grade of steel, which I have no doubt is better in all respects than iron, as it must be more uniform in texture, and more certain to be free from developing blisters and other bad spots which are so frequently shown in the youth of iron, and I shall continue to use it for all classes of boiler work.

We have some remarkable cases of longevity of iron fire-boxes on the A. G. S. Ry., among which is engine No. 127. This engine was built by the Rhode Island Locomotive Works, and entered service in 1870, its fire-box being constructed of Sligo iron. During the first eight years of its service wood was burned, and since that time it has burned coal, the box being still in first-class condition.

We have four other engines equipped with iron fire-boxes, which I wish particularly to mention, viz., 102, 103, 104 and 105. These were built by Hinkley & Williams of Boston, Mass., and entered service in 1869, the former two having fire-boxes of Low Moor and the latter Sligo iron. The record of these irons would show slightly in favor of the Sligo, as engines 102, 103 and 104 gave trouble some four or five years ago, and have since completely given out, while the box of No. 104 is still in fair condition.

It will thus be seen that while the iron fire-boxes, being of long service, have worn out completely, the steel boxes have given no trouble whatever up to date, yet I wish to say here, that if there was any possibility of obtaining a quality of Sligo iron of as uniform texture as steel, I would have serious doubts as to the latter being the better; however, trusting to our own observation, we will have to wait for time to decide.

In connection herewith I beg to say that I forwarded your letter to Mr. G. Bouscaren, consulting engineer of this system, whom I believe to be an authority on such subjects, being eminent in his profession, having given the subject of iron and steel considerable study, although perhaps mostly as regards other applications, and any additional thoughts which I might have given my opinion on I find have been covered by his letter.

I enclose a copy of his letter, which I trust and believe will be of interest to you.

JAMES MEEHAN,
S. M. P. & M.

LUDLOW, Ky., Jan. 25, 1886.

James Meehan, Esq., S. M. P. and M.:

DEAR SIR: Replying to your favor of the 4th inst., referring inclosed letter of Mr. Angus Sinclair, I do not know that what I can say on the subject will be of much value to that gentleman, as his inquiries are not so much for individual opinion as for facts showing the present condition and tendency of American practice with regard to the use of steel for the construction of the boiler and fire-box of locomotive engines, and I am quite sure that you can speak more authoritatively as to these facts than I can.

I confess considerable surprise at the statement that some roads are abandoning steel and coming back to iron, as I believe that the use of steel, when properly applied, has been uniformly successful, and has been very generally adopted in the United States.

I am aware that such has not been the case in England and France, but the discussion of Mr. Perrie's paper on "Mild Steel for the Fire-Boxes of Locomotive Engines in the United States of America," read before the Institution of Civil Engineers of England in January, 1883, shows, I think, pretty conclusively, that the failures of English and French Engineers in that direction were due either to the fact that the steel used was too "high" or too *thick*, or both.

Take for instance the "Caledonian Railway of Scotland," one of the first foreign roads which tried the experiment. Steel fire-boxes built on that road in 1861, with tube plates $\frac{5}{8}$ in., back $\frac{5}{8}$ in. and side plates $\frac{7}{16}$ in. thick, were found to be in good condition in 1871. Encouraged by that fact, the road built other fire-boxes in 1871, with increased thickness of plates, viz., tube plate $\frac{3}{4}$ in., crown sheet $\frac{1}{2}$ in. and side sheets $\frac{1}{2}$ in. These failed in every instance by cracking with loud reports.

About the same time the Orleans R. W., of France, built five locomotives with steel fire-boxes, four of which exploded within twelve months, putting an end to further experimentation in that direction.

I am not informed as to the quality and thickness of the steel in this case, but am quite certain that the failure must be attributed to overthickness of plates.

The Grand Trunk R. W. of Canada, and the Penn R. R., which have been among the first in America to adopt steel for their boilers, are, I believe, well satisfied with the innovation, and have entirely discarded iron. Their success must be attributed, I think, to the softness and purity of the steel, as well as to the moderate thickness of the plates used. It would, therefore, seem that the question reduces itself to the solution of a steel of proper quality and thickness, and to the proper working of it into shape.

The Pennsylvania R. R. specify for their fire-boxes a steel that will break between 55,000 and 65,000 lbs. tension per square inch, with not less than 30 per cent. elongation in 2 in.

This metal must be so low in carbon and other hardening elements, that it is perhaps improper to call it steel, but whatever may be its proper denomination, it seems to answer the purpose very well on the Pennsylvania R. R., and the only change I would suggest in the specification as given above is the addition of a clause prohibiting as far as practicable the presence of manganese, phosphorus and sulphur in the metal. The following points seem to be also well established in practice:

1. The metal of the fire-box must be as thin as consistent with safety, considering the pressure which the boiler is intended to carry, so as to yield more readily to the differences of temperature which obtain between the inside and outside walls of the fire-box, and to transmit the heat also more readily.

2. The corners should be turned with as large radii as possible, and stay-bolts should not be put in too close to the corner to allow more free play for deformation due to difference of temperatures.

3. The metal should not be annealed, as annealing in this case seems to render the metal more apt to crack.

4. More care should be exerted in keeping the immerged surface clean, as the steel seems to be more subject than iron to burning, and then conductibility is much decreased by the formation of scales and mud deposits.

With regard to the evaporative power of the boiler, the advantage of steel as compared with iron is obvious. Owing to the reduced thickness of metal, more heat is transmitted in the same time through the same area, and more steam is produced with the same heating surface.

G. BOUSCAREN, C. E.

LUDLOW, Ky., Nov. 6, 1885.

Radial Valve Gear.

Editors Car and Locomotive Builder:

It was not until this late date that I was aware of Mr. Joy's communication in your February number, in reference to my paper on "Some Modern Valve Gears," a report of which you had published in your October number of last year. I hasten to answer in time for your next issue.

Let me say in the first place, that my paper is anything but a "covert" attack. I think that I stated things plainly enough, and so that everybody might judge for himself, or investigate to his heart's content. I gave the dates of patents, and I presented blue-prints from the files of the Swiss Locomotive and Engine Works, in Winterthur, a most reputable firm of over 15 years standing. If Mr. Joy wishes any further evidence, why does he not examine the order books of the company, find out where the engines of the design of 1877 went to, and follow up the clues I had furnished. This is the course common sense would dictate, and which honesty of purpose would pursue. If I am not very much mistaken, those engines went to Barcelona, in Spain, and Mr. Joy, instead of stately striding on "leaves in Vallambrosa," had far better trod to solid facts in Barcelona.

Did I say that Mr. Brown patented his slot-link of 1877, and does priority of an invention consist in the patenting of a device? If Mr. Joy will carefully read my paper he will readily discover why Mr. Brown, who at the time was principally engaged in locomotive building, preferred the compounded radius bars. But none are so blind as those who do not want to see. Verbiage as to what a man might, could or would have done, or the quotation of entirely irrelevant court opinions—irrelevant as far as Joy vs. Brown is concerned, but very pertinent in the case of Brown vs. Joy—does not alter a single fact.

Mr. Joy wants to make your readers believe that "In Europe, especially in England," Mr. Brown has not seen fit to raise any question of the kind" (*i. e.*, the question of priority). This statement is so characteristic of Mr. Joy's methods that you will kindly permit me to submit the following letter of Mr. Brown to the editor of *Engineering*, and published in that journal Oct. 1, 1880:

To the Editor of Engineering:

SIR: I read with much interest your report of the paper read by Mr. Joy before the Institution of Mechanical Engineers, at the recent Barrow meeting, on a "New Valve Motion," but absence from home has prevented me from writing you respecting it earlier. Having perhaps more experience in the construction and working of this class of valve motions than almost any one else, I can speak with confidence as to their good qualities, and the great facility with which they can be adapted to almost any case.

Between the years 1840 to 1850, a patent was taken out by a French engineer for a valve motion identical with that patented later by Mr. Hackworth, and generally known by his name. This contrivance, together with the Belgian valve gear, known by the name of Walschaert, may be looked upon as the parents of the

valve gears about to be described. In 1867, I made the first attempt with a gear similar to Mr. Hackworth's, but with a curved slot to eliminate the errors produced by the straight slot of Mr. Hackworth. This I used until 1874, when I designed the gear which was published in *Engineering*, Oct. 29, 1877. The object of this type was to work the valves of locomotives without the use of return cranks or eccentrics, and to substitute for the "slot motion" a system of radius rods, the slot motion not being adapted for locomotives on account of the great wear. This type has proved very successful in every respect, and has been applied to over 100 locomotives. This, I think, will suffice to dispose of Mr. Joy's assertion that my valve gear "was specially adapted to working light double-beat valves."

The skeleton diagrams annexed will show some modifications of *my plan** in use or projected, but do not by any means include all the forms which this gear may assume according to the purpose to which it may be applied.

Fig. 1 is a simpler form of the gear already published in *Engineering*, but it is less easy to handle with the reversing lever, consequently there is more strain thrown on the articulations, and this neutralizes somewhat the gain on the side of greater simplicity. Fig. 2 was applied to a chain locomotive with vertical cylinders; *this gear seems to me to be identical with Mr. Joy's.** Fig. 3 shows the valve gear of a small marine engine worked with an eccentric; this is identical with Mr. Marshall's. Fig. 4, 5 and 6 are gears for locomotives without working beams, the motion being taken off a supplementary connecting rod. Fig. 7 and 8 is a modification of Walschaert's gear, which I have much used for locomotives. This type also gives a very exact distribution, and is useful where room is wanting for the development of the former types. Fig. 9 shows a modification of the above.

I will not intrude on your space to give details of the above valve gears, as by means of the description of my valve gear, which was published in *Engineering* and Mr. Joy's paper, your readers will already be familiar with the properties of this class of valve motions.

I am yours truly,

WINTERTHUR, Sept. 20, 1880. C. BROWN.

This letter has not been answered by Mr. Joy to this day. Yet Mr. Brown has never seen fit to raise any question of the kind!

Concerning that part of Mr. Strong's valve motion which is an adaptation of the *Brown* gear, I can refer to my paper. As to the rest of Mr. Joy's allegations, Mr. Strong will speak for himself.

What Mr. Joy pleases to term his invention has a world-wide fame and reputation, so also have "Holloway's Pills," "Radway's Ready Relief," and other patent medicines. Can Mr. Joy name a single American railroad company that ever built a second "slot-link" after they had sufficiently recovered from his first dose?

In conclusion, I would state that my sole desire in writing my paper was to give credit to whom I consider credit is due.

NEW YORK, FEB. 17, 1886. OTTO GRÜNINGER.

Editors Car and Locomotive Builder:

On my return from California, I find the February number of your journal, with a letter from Mr. David Joy, attempting to answer statements in Mr. Grüninger's paper on Radial Valve Gear, read before the Master Mechanics' meeting at Washington. I am sorry to see any man, who pretends to be a gentleman, descend to the low plane and attempt to throw dirt, as is characteristic of this letter. As the first part of the letter is directed against Mr. Grüninger and Mr. Brown, I will trust to them to answer it, as I well know they are able to take care of themselves. Mr. Joy says, however, that heretofore he has had amicable relations with Mr. Brown. I would ask him about that letter from Mr. Brown to *Engineering*, of Oct. 1, 1880, and why it remains unanswered to this day in the columns of *Engineering*.

Now, as to his statement that I made arrangements with him to use his gear, I never had any agreement with him, nor did he furnish me with any tracings, drawings or blue-prints of a valve gear with a fixed sector quadrant, or "sword-arm," as he calls it. Nor had he published any such design prior to my application of this device to a locomotive, but after it had been successfully used by me and my patent allowed and granted, he came out with a plea of hurt. The best informed engineers in the country, and those who have been in England, do not believe Joy ever made an application of what he calls his "sword arm" design, at least not on a locomotive, and I challenge him to name a single instance in which it has been applied to a locomotive.

As to the valve gear I am now using, I adopted it after having tried the arrangement of levers claimed by Joy, which he copied from Brown's 1877 gear, and found it defective in several points, one of which was its slow starting, another was its closeness to the ground and disposition to pick up dirt, and an ugly motion that the lower bar had; and after experimenting with the arrangement of levers used by Charles Brown, and found by him to be the most satisfactory, the one that he had on his automatic engine at the Paris Exposition, in 1878, and patented in Europe and in this country three years prior to Joy's patent on an entirely different gear, I found it to give a better motion than the other, and have adopted it as a standard and find it has no faults, is all up out of the dirt, and one standard gear answers for all classes of engines on a standard road, whether it be a 4, 6, 8 or 10-coupled engine. I have purchased Mr. Brown's patent, and shall continue to use his gear with such improvements as I have made to adapt it to the peculiar work it has to do; *i. e.*, working independent steam and exhaust valves.

Mr. Joy is a copyist, and has never made a single improvement on Brown's gear as he found it, and did not even have the good judgment to select the best form of gear, but took up a discarded design, and with all his experience, opportunities and failures, he has not overcome a single objectionable feature as a genuine inventor or engineer would have done under similar circumstances, and from all the information I can get, I am led to believe he has not a single spark of originality about him. As for myself, I am willing to let my work talk for me, and those who know me can judge as to my ability to at least sift the wheat from the chaff. GEO. S. STRONG.

NEW YORK, Feb. 17, 1886.

* This underscoring is *my own*. Nine different cuts accompanied Mr. Brown's letter. Fig. 2, mentioned above, is identical with Fig. 3 of *my* paper. Figs. 7 and 8 in the letter are also similar to Figs. 7 and 9 of *my* paper.—*O. G.*

Car Seats.

Editors Car and Locomotive Builder:

My attention has been called to a communication signed "Helios," in the *Railroad Gazette*, taking me to task for the expressions in my letter published in your February issue, objecting to the gratuitous abuse of car seats indulged in at a meeting of the New England Railroad Club. The article is long, but as it is principally devoted to expressing, in a roundabout way, the opinion that I am a very incompetent and unreasonable person, there is little to reply to. It says I am full of wrong-headed impressions, that I imagine no improvements should be brought forward until there is great public demand for them, and that I must be a very unobserving man, or a patentee of an extra uncomfortable seat. I am not a patentee of any kind of car seat, and Helios may rest assured that if ever I invent a car seat of any kind, I will not use a meeting of a railroad club to give it gratuitous advertising. It may be wrong-headedness that makes me look at the subject in this light, but although old-fogy notions would have prevented me personally from doing the same thing, I had no objection to Mr. Forney using the meeting of the N. E. R.R. Club to advertise his car seat, and my only objection was based on the immodest attempt to make his invention seem good by calling existing seats very bad. Because I have raised my voice to protest against this way of bringing people's wares to public notice, it does not follow, as Helios assumes, that I stand out as an antagonist to desirable improvements. The road I am connected with employs an able master car-builder, who takes an active, live interest in making cars comfortable, so that our patrons may have no reason for complaint, for we recognize the fact that it would not pay the road to have passengers dissatisfied. Most other companies follow a similar policy, and when one introduces what is recognized as an improvement, the others quickly follow suit. The correspondent of the *Gazette* implies that all our master car-buildere are incompetent, and that they must needs put themselves under Mr. Forney for instruction in their business; but I, like many others, prefer to rely on the judgment of master car-builders as to what is proper for car equipment, rather than defer to the advice of Mr. Forney, who, as I understand the case, is an experienced editor, but neither a mechanic nor railroad man, besides being, by his own showing, by no means disinterested in car seats.

Helios wishes us to understand that he, personally, has had extended and varied experience of railroads. If he has had any experience as a railroad superintendent, it is curious that he has stumbled into the blunder of supposing that the public refrain from ventilating any grievances they may entertain against car-seats or any other thing connected with railroads. The shortest experience in this position would have satisfied him that the average traveler is not troubled with timidity in approaching railroad officers for the purpose of fault finding, that in truth he is ever ready to freeze on to any official and cling to him till all grievances, real or imaginary, have been given full and free expression; also, that there is not the remotest danger of a railroad company subjecting its patrons to discomfort without knowing it. The average car seat is more comfortable than the average chair used by the traveler in his home, and nothing that Helios has said is calculated to change the average railroad man's belief, that the people who find fault with car seats are a small but troublesome minority of chronic, constitutional grumblers, who are never happy excepting when they are making their neighbors miserable. SUPERINTENDENT.

Cheap Car Inspection.

Editors Car and Locomotive Builder:

I have read with much interest and amusement the "Dialogue about Car Wheels" in your last issue, but I think the writer left off a little too soon. I would like to ask which is the worst, cheap labor or cheap material? I refer to the labor performed by inspectors, and have often wondered that such an important part of railroading as car inspection should be intrusted to men who only get from $35 to $40 a month, and work Sundays at that. In case of an accident from breakage of a wheel or other part of the running gear, I would like to know what better evidence against the road a lawyer would want than the fact that inspectors are paid such a small pittance. Suppose an inspector, from lack of interest in his work or from carelessness—poor pay will produce both—lets a cracked wheel get by him. It runs a few miles and breaks, ditching the train and causing a $10,000 wreck. The inspector can easily clear himself by claiming the crack in the wheel to be a new one which occurred after the car had passed him, even if he knew to the contrary, and if discharged he would lose but little by it. It may be said that there is a foreman with big pay to look after the inspectors. This may be, but I would like to know what a foreman can tell about cracked wheels while walking six feet away from the car, on one side of the train at that, waiting for the inspector's report?

I am positive that no more than fifty per cent. of inspectors can read the M. C. B. Rules for Interchange of Traffic, and that half of this number are lacking in the judgment that should be used as respects a car, at home going home, and going away from home, a thing that is very important where inspectors are distributed all over a city, and do not see the foreman once a week perhaps. How many delays and accidents are caused by poor judgment? How many cars are condemned and switched out of trains for some trifling thing, and then banged around the yard for twelve hours before the trifling nature of the defect is discovered. It is then sent on its way, if it is not in the mean time broken somewhere else through rough usage in the yard, all the result of cheap inspection.

REPAIRER, No. 2.

Freight Brake Tests.

Editors Car and Locomotive Builder:

I notice in the last issue of your paper the circular of the committee of the Master Car-Builders' Association, inviting the manufacturers of freight car brakes to a competitive test of such brakes, to be made at Burlington, Ia., July 13, 1886. The first condition prescribed for the tests, as stated in the circular, requires each brake company to furnish 50 cars equipped with its brake, the cars to be delivered free of charge at some point on the line of the C., B. & Q. Railroad on or before July 7.

Such a condition as this is well enough, perhaps, for brake companies with half a million capital, but it entirely excludes individuals who may have a good practical brake, from participating in the tests. In order to give such parties a fair chance to compete with the brake companies, I would suggest to the Association the propriety of designating a time and place for the examination of more recently invented brakes, by models. In view of the fact that new brakes are brought out about every month, the plan might prove a benefit to all parties concerned.

L. C. HUBER.

HUBER, KY., FEB., 1886.

[Our correspondent is evidently the inventor of a freight car brake and wants to have it recognized as a competitor in the proposed tests, but being unable to comply with the conditions imposed by the committee, he suggests that the Association should provide for the examination of models. This would, of course, bring together a large number of models representing devices, good, bad and indifferent, not one of which could be designated as being worthy of general adoption until the brake itself had been tested in practical service to a greater or less extent. The need for some final action on the part of the Car-Builders' Association is urgent, and if our correspondent, and other inventors who are in a like predicament, can not have the 50 cars ready for the brake tests next July, it is their misfortune. The time has passed, even if there ever has been such a time, when the Association can take any decisive and final action upon the mere examination of models.—EDS. C. & L. B.]

Defense of Northern Pacific Railroad Weather.

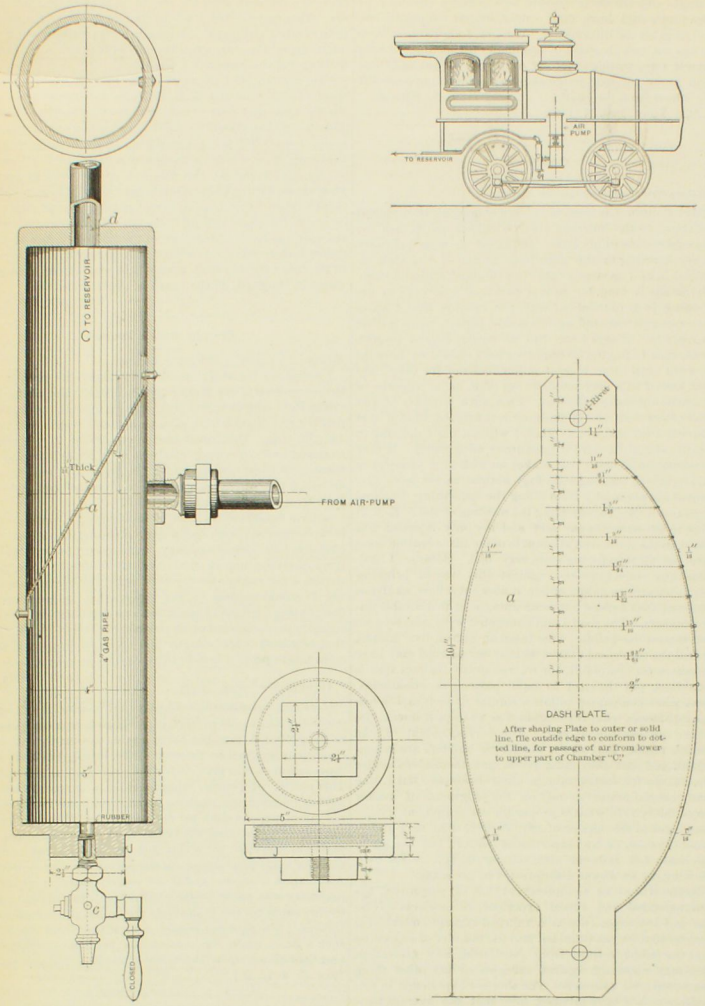
We wished to look over some of the shops belonging to the Northern Pacific Railroad, but were afraid to go out there lest we should spend more of the winter than we could well spare in the snow bank. Having mentioned this reason for keeping away, to a most intelligent engineer belonging to the road, we received in a private letter the following racy defense of their weather:

"There seems to be a wrong impression concerning the weather we have up here. It seems to be a lasting impression of a soiled reputation gained when the road was in its first stages in gaining experience; when the banks of the cuts were close to the track, snow fences few and far between, water tanks and fuel stations ditto, when engines were small and men of experience in severe climates scarce. Such, and many other causes combined to give a poor reputation; they were unavoidable at the time, but since have been removed. The track at one time lay on the grass on the level prairie. It has long been raised, and now the snow sweeps over it, and instead of lodging and piling up drifts onward in its journey from Manitoba to somewhere else. The cuts have been widened and sloped, and it would seem that God helping those who help themselves, lends assistance, for very little snow has come for the last three years.

"Engines are equipped with plows just the same, and stand ready for service on any emergency. Splendid machinery, with boilers in good shape and the cabs back-boarded, side-curtained and frost-windowed in proper shape for comfort and efficiency. Our trains are run on time, excepting when required to run slow in extreme weather as an extra precaution for safety. With mercury 40° below zero, I run my engine with no more clothing than in ordinary weather. These real cold snaps last but about three days at a time, and during such a period I use gloves when oiling around, but at most times go without gloves or ear covering while on duty.

"It seems to me that it is about time the sentiment concerning Northern Pacific winters and climate was changing. Even the devil ought to have his due, and if this imaginary devil of a climate would get its just due, it would be regenerated and quite angelic and positively attractive, not to say respectable."

THE following railroads were the heaviest purchasers of steel rails for the period of 1885 up to December 1: Pennsylvania, 36,000 tons; Missouri Pacific, 45,000; St. Paul, 68,000; Northwestern, 30,000; Atchison, 25,000; Chicago, Burlington & Quincy, 15,600; Chicago, Burlington & Northern, 20,000; Rock Island, 18,000; Illinois Central, 13,600; Manitoba, 15,000; Union Pacific, 30 000; Minneapolis & Northwest, 16,000.



Water Trap for Westinghouse Brake.

THIS trap is used in connection with the air pump of the Westinghouse brake, for the purpose of catching the oil and sediment and preventing its entrance into the air pipes and hose. It prevents water from accumulating in the hose, and thus from freezing in the winter, and also prevents rotting of the hose by oil. The trap is drained at will by small cock at bottom. It is very simple in construction. The main or barrel part is 4-inch gas pipe, has top head welded into it, and dash-plate is held fast in center of barrel by one rivet at top and one rivet at bottom, and has about $\frac{1}{8}$ of an inch clearance from sides of barrel for air passage. The water and grease coming from pump is discharged against dash-plate, and its being on an incline is forced to the bottom of trap. The bottom cap or head is screwed on, so that, if in course of time grease accumulates and hangs to side of barrel, the cap can readily be unscrewed and the grease scraped out. There is nothing about it that needs any repairs, and it is cheaply made.

The Best Material for Car Sills.

The January meeting of the Western Railway Club was postponed, owing to bad weather, and at the second meeting very few members attended. A short discussion was sustained on The Best Material for Car Sills.

Mr. Snow thought that the best material for the purpose was either southern yellow pine or Norway. Norway was doubtless the stronger, as it stood transverse strains better. The Southern, however, he believes to be the stiffest timber, and preferred it to the other, although he was of the opinion that in a derailment the Norway would stand it much better than the Southern pine. The Norway was the most flexible. For end sills he uses oak. Concerning repairs, he did not believe that there was any difference as regards the matter of expense, when the various timbers were used, except in the first cost. He used Southern pine principally because it was the cheapest, it being delivered to him free of any transportation charges. He said that they once had a lot of cars built in Buffalo and they had the best sills he ever saw. Every stick was of hickory and they proved to be first class. As to spruce, he had worked with that 40 years ago. Everything was spruce, sheathing, floors, etc., and it was good material to handle. It was his custom to make the two center sills of oak. Mississippi timber is apt to decay if the sap is left on the corners, which is quite a common fault. Norway, however, was just as apt to do the same.

Mr. Verbryck said that he was using altogether Norway pine for his longitudinal sills and oak for his end sills. He used to think that the southern pine was the best for car sills until a few years ago, when, at one of the car-builder conventions, Mr. W. R. Davenport, of the Erie Car Works, related some of his experiments with Norway and long leaf Southern pine. The samples which Mr. Davenport had with him, and which had been tested to see which withstood the most strain, showed the Norway to be the best adapted for car sill purposes. The southern he still believed to be the stiffest, and thought if the real article could be obtained, without having been tapped, it would last much longer than the Norway. Regarding his experiences with timber other than Norway or southern pine, Mr. Verbryck said that in 1862-63 the Erie road, with which he was then connected, bought the material for 100 cars from the Portland (Me.) Car Works. It had been ordered by the Grand Trunk Railway, which for some reason failed to take it. He had the material shipped to him, and he put the cars up. The sills were all of spruce, and they were the best cars he had ever seen. They gave the Erie better wear than any cars they had previously had. The timber was exceedingly tough, and he thought that there were some of the cars on the road yet. He was not prepared to say whether the sills would last longer than the long leaf southern pine or not. His experiences with the Norway have been good, and he likes it very well.

Important Notice to Enginemen.

The following notice has been issued by the Machinery Department of the Milwaukee, Lake Shore & Western Railway Co., for the instruction and guidance of the enginemen of the road :

1. The fuel consumed by locomotives being so large a part of the operating expenses of the road that many mechanical devices are being tried in order to lessen the amount consumed. Extravagant, irregular and careless firing will, however, defeat every effort we make towards economy of fuel.

2. It is a common practice for some firemen to throw a large amount of coal into the furnace at one firing; in this case the coal being so thick on the fire, it cuts off the air supply that should come through the grates; in consequence the coal on top is rapidly coked by the heat underneath, and the gas and smoke (the very cream of the coal) escape unconsumed. An equal amount of coal placed in the furnace in three or four firings instead of one, would in many instances evaporate much more water and reduce very much the amount of black smoke.

3. A matter of equal importance is the proper admission of air to the furnace. The dampers should be regulated to govern this. When too much is admitted, although helping to consume the smoke and gas, it lowers the temperature of the fire-box, with a consequent loss of steam, and, when not air enough is admitted, much of the coal becomes coked, caused by improper combustion in the fire-box. The amount of air admitted must therefore be in proportion to the quantity of coal and steam used, and as this varies with the load hauled, the grade ascended, and the speed, so also must the supply of air and fuel vary, and the enginemen must see that both are fed to the furnace in a regular and careful manner, always proportionate to the work done by the locomotive.

4. Engineers and firemen must also see that the coal is properly broken and wet down before firing, and that it is distributed equally over the grate surface.

5. The frequent "blowing off" of a locomotive, caused by having too much steam, is an indication of carelessness and waste of fuel on the part of the enginemen, and with due care and attention to duty it can nearly always be avoided.

6. By strict attention to these simple rules, with a due regard on the part of the engineer to working the engine as economically as possible, always remembering that it takes money to produce steam, and should be dealt out with judicious care, and always taking advantage of its expansive qualities, much coal that is now wasted would be saved. Another source by which much fuel is wasted is the manner in which some engineers admit the feed water; they will put on the injector or pump to its full capacity until the boiler is filled, when they will shut it clear off until it again requires filling, and this performance is constantly repeated during the trip. This vicious practice causes not alone great waste of fuel, but is destructive to the boiler from its constant change of temperature. To get the best results, the feed water must be admitted as constant and even as the steam is used, and should be graduated closely to that point.

7. The management of the road expressly desires that enginemen give these matters their closest attention, and that they post themselves fully on the points governing the economy of fuel, and in justice to the men and the company, they wish it clearly understood that hereafter engineers, either in the first, second or third class, showing the best record for econ my in dealing with the company's supplies will be the men first selected for promotion.

Approved by H. F. Whitcomb, General Manager; J. Donohue, Superintendent; J. Hickey, Master Mechanic.

Ordering, Inspecting and Sampling Materials for the Pennsylvania Railroad.

We copy the following portion of a circular of instructions for Ordering, Inspecting and Sampling Materials, issued by Theo. N. Ely, General Superintendent of Motive Power of the Pennsylvania Railroad :

1. Hereafter all requisitions for any of the materials mentioned below must specify the same "As per P. R. R. Co. Specifications." As new specifications are prepared from time to time, instructions in regard to the inspection and sampling of the materials specified will be issued and must be carefully observed.

2. When material has been received, it must be carefully inspected and compared with the bill. If any discrepancies are found, a statement of same, together with the bill, not signed, must be sent at once to the Supt. M. P. for adjustment.

3. The instructions given below must be rigidly observed, and in no case must any portion of a shipment be used until report of test, announcing materials ready for use has been received, except by special permission from the Superintendent of Motive Power. The report of test must always be attached to bill when this is signed.

4. The above instructions do not apply to materials received by one shop from another, but only to those received from manufacturers or dealers.

5. The inspection and testing of materials will be done in part by or under the supervision of the party to whom the materials are consigned, and in part by or under the supervision of the Chemist and the Engineer of Tests at Altoona.

SPECIFICATIONS FOR AXLES.

Car axles and locomotive tender and truck axles will be ordered subject to the following conditions, which annul all previous requirements:

For each 100 axles ordered, 101 must be furnished, from which one will be taken at random, and subjected to tests prescribed for such axles.

Locomotive tender and car axles to have journals swaged, and all axles to be centered.

Passenger Car and Passenger Locomotive and Tender Truck Axles.

Axles must be made of steel and be rough turned throughout.

Two test pieces will be cut from an axle, and the test sections of $\frac{5}{8}$ in. diameter by 2 in. long may fall at any part of the axle, provided that the center line of the test section is 1 in. from the center line of the axle. Such test pieces should have a tensile strength of 80,000 lbs. per sq. in. and an elongation of 20 per cent. Axles will not be accepted if the tensile strength is less than 75,000 lbs., nor the elongation below 15 per cent., nor if the fractures are irregular.

Freight Car and Freight Locomotive and Tender Truck Axles.

Steel.—Steel axles for freight cars and freight locomotive and tender trucks will be subjected to the following test which they must stand without fracture. Five blows at 20 feet of a 1,640 lbs. weight striking midway between supports 3 ft. apart; axle to be turned over after each blow.

Iron.—Iron axles for freight cars and freight locomotive and tender trucks are to be hammered; the iron must be doubled rolled from muck bar not exceeding $\frac{5}{8}$-in. in thickness—it must be tough, fibrous, uniform and free from scrap. Such axles must stand without fracture 3 blows at 10 ft. and 2 blows at 15 ft. of a 1,640 lbs. weight, striking midway between supports 3 ft. apart; axle to be turned over after each blow.

DECORATIVE DESIGNS FOR OUTSIDE OF STREET CARS.

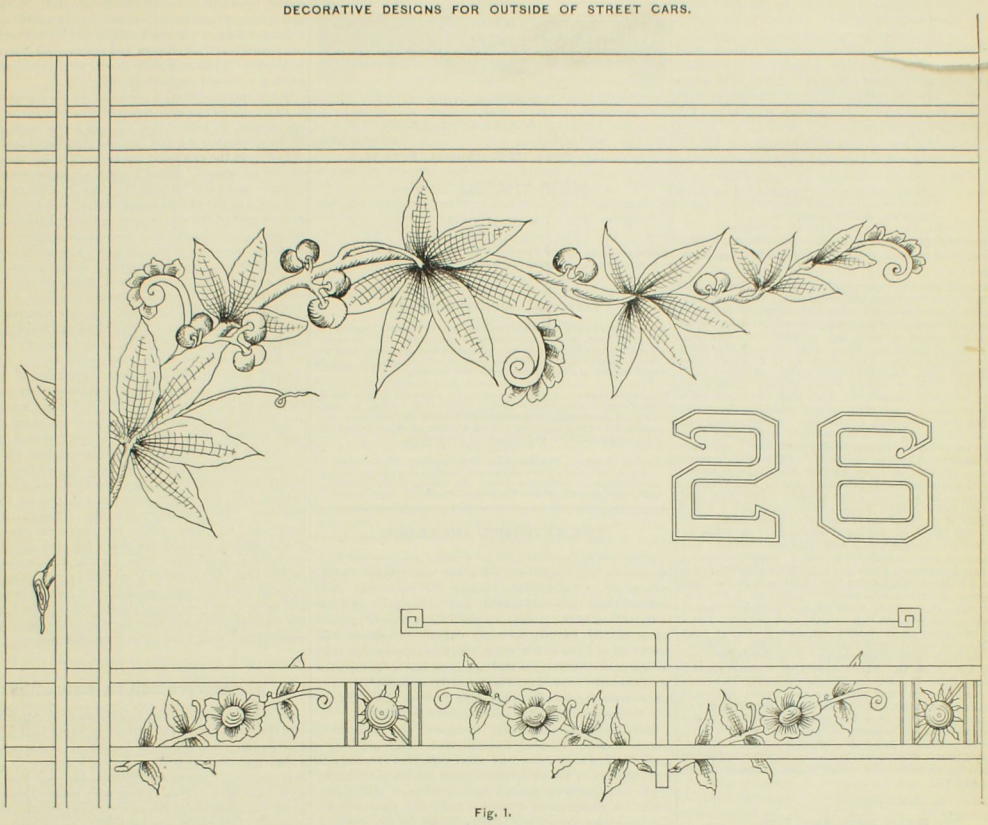


Fig. 1.

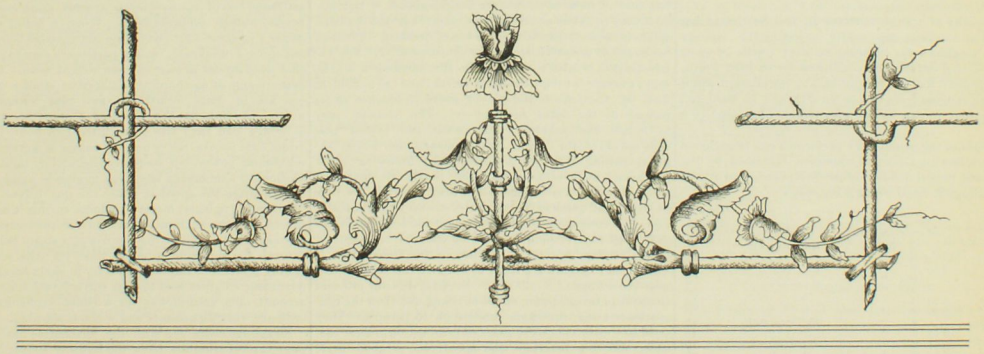


Fig. 2.

Fig. 1 is an outside top corner design. When applied to a panel running the whole length of the car, the car number should be placed in the center, with the bracket underneath the number. If the car side is divided into three panels, the number, with the bracket under it, is placed in the center panel. Fig. 2 is intended for outside bottom panels, the dividing battens being crossed by the horizontal sticks at the points where they terminate in the cut.

A Persevering Machinist.

In our last issue we noticed that Mr. A. F. McLatchey had been appointed Superintendent of Motive Power of the Louisville, New Albany & Chicago Railway. The career of Mr. McLatchey is a good illustration of what industry, energy and perseverance can do to push a man towards the top of the railroad ladder. Ten years ago, Mr. McLatchey was an apprentice machinist in the Chicago, Burlington & Quincy Railroad shops at Aurora, Ill., with no capital but his hands and head, and no influence but what work well done gained him. Like thousands of other young men who begin the machinist trade, he had received no technical or scientific education, and night schools for the instruction of aspiring mechanics had not yet been established in Aurora. McLatchey perceived before he had been long working in the shops that he must acquire scientific instruction as a lever to raise himself above the position of ordinary workmen. As a first step he prevailed on Mr. A. McIntosh, foreman pattern maker, to give him lessons in mechanical drawing, at which he labored diligently early and late. This was alternated by self-conducted studies in mechanics, and different studies relating to mechanical engineering. About the time his apprenticeship was finished, he had become so expert in drawing that he was placed in the drawing office, where, in the course of time, he rapidly rose to the position of chief draftsman.

Desiring to obtain an extended personal experience of railroad operating, Mr. McLatchey left the clean, comfortable position of chief of the drawing office for the hard, rough work of locomotive fireman. This work he followed cheerfully and industriously until he was promoted to the right-hand side. From running a locomotive on the Chicago, Burlington & Quincy road, he was appointed to his present position. There is no such thing as keeping down men who develop the self-helpful spirit displayed by Mr. McLatchey.

Recent Car Couplers.

It was generally expected that the selection by the Master Car-Builders' Association of certain couplers for probation, with the view of recommending some or all of them for adoption by railroad companies, would have the effect of deterring inventors from devoting time, industry and ingenuity to the invention of new couplers, but this does not appear to have been the case. The patent records for January indicated that eight new and valuable inventions in this line had received the protection of letters patent, and a single week in February recorded the granting of eight more patents to car coupler inventors. Many of the inventions look worthless, but others appear to possess merit. The most surprising thing about this invention of car couplers is the undeniable mechanical ability exhibited by many of the inventors. Among the late inventions we observe a new arrangement of the Barnes Car coupler. This coupler attracted considerable attention during the Buffalo tests, and the fact was undeniable that it never failed to couple. The greatest objection raised against the coupler was, that it coupled and did its work away down below the line of the draft timbers. In the improved coupler we observe this defect has been reme-

died and the hooks connect with pins in the draw-head. Several improvements have been effected in the Cowell coupler. Two separate patents cover these improvements, and another hook coupler, the invention of John W. Marden, Waltham, Mass., has been assigned to the Cowell Platform and Car Coupling Company. James O'Riordan, Ulster, N. Y., has invented a link coupler to connect with a lug cast on the draw-bar. He appears to have got the device patented by family compact, for there are no less than fourteen asignees—mostly O'Riordans. We believe the family's money would have been safer in a very shaky savings bank.

Pullman Buffet Lunches.

A writer in the *Railway Magazine* relates his experience in the matter of lunches of the Pullman buffet car style, as follows:

"It was my good fortune to be traveling on the Atlantic Coast Line a few days ago, and fortunately the train made no stop for supper, and still more fortunately I was in a Pullman buffet car. I ordered some bread, and the slices were so little, and so thin, and so hard, they might do service as Saratoga chips. There were four of the chips and they cost ten cents. They were good enough, what there were of them, and there were plenty of them, such as they were. Then I wanted a glass of milk to soak up the chips and swell them out. The milk was ten cents too. There wasn't much milk, either, although there was a good fair deal more than I cared for. Sweet milk I can drink considerable of, but it doesn't take much sour milk to satisfy me. On the dainty little bill of fare I also saw "baked apples and cream, 15 cents." Of course I must have some of that, it is so awfully English, you know. Queen Victoria likes baked apples and cream. The "cream" was brought in a tiny little pitcher, just like real rich cream, but it looked suspiciously thin, and I asked the waiter if it was more of that sour milk. He replied, "Oh! no, boss, dat haint sour milk." I ventured to taste it. No, it wasn't sour *milk*, that was certain! But what manner of compound it was, I couldn't tell. I began to get interested. Here was some kind of a deli-acy—I was on a Pullman Buffet Car, you know—It tasted just like it seems chalk and water ought to, but as I am not familiar with the actual taste of chalk and water, I couldn't be positive it was chalk and water. But I was just as certain as the waiter was that it wasn't sour milk. No, you might carry that kind of milk, "cream," I mean, through seven summers and it wouldn't get sour. I didn't use it on the baked apples—it was too great a delicacy for that. I got it on a Pullman Buffet Car, you know. And then, if I had put it on the baked apples, it *would* have tasted sour. Oh! it is such a comfort, not to say luxury, to get a lunch when you want it, and if the train does not stop for supper you usually do want it, on a Pullman Buffet Car, you know; and it is such a comfort, not to say luxury, when you have the waiter apologize for the beastly victuals—the waiter on the Pullman Buffet Car, you know."

The Rotary Steam Snow Plow.

The severity of the past winter in the Northwest has afforded an excellent opportunity for testing the capacity of these machines for clearing railroad tracks of snow under the most unfavorable conditions; or in other words, where the snow had drifted into cuts by the blizzard winds to a depth ranging from two to ten feet, and so hard and compact that it can be cut into blocks like stone in a quarry.

Some idea of the actual work performed can be gathered from the following tabulated statement furnished by Mr. M. Hopkins, Superintendent of the Northern Iowa Division of the Chicago & Northwestern Railway:

Length of cut.	Average depth of snow on rail.	Condition.	Time of opening. Hrs. Min.
1,350	5 feet	Hard as rock	21
1,440	3 "	" "	11
720	4 to 6 "	" "	13
1,440	9½ "	" "	1 52
1,250	4½ "	" "	15
1,420	3 to 4 "	" "	13
1,260	2 to 4 "	" "	10
40	6 "	Cut even full	15
1,620	3 to 6 "	" "	45
1,080	5 to 6 "	Hard as rock	10
1,620	4 to 8 "	" "	27
1,080	7 to 10 "	" "	31
1,800	5 to 8 "	" "	16
720	5 to 9 "	" "	18
1,440	3 to 7 "	" "	07

The machine, which is a plow, shovel and excavator all in one, was built at the Cooke Locomotive Works, Paterson, N. J., for the Rotary Steam Shovel Manufacturing Co., of which Mr. J. S. Leslie, the inventor of the machine, is President.

THE annual report of the Board of Trustees of the New York and Brooklyn Bridge for the year ending December 1, 1885, says that the receipts for the twelve months have been, for promenade, $23,011.34; carriage-way, $58,468.32; railroads, $537,435.09; total, $618,914.75. This is $84,921.75 in excess of the receipts of 1884. The total number of passengers carried on the railroad in the year ending December 1, 1884, was 8,529,840; while 17,023,237 passenger used the railroad in 1885, but there were 328,911 less foot passengers in the latter year. The whole number of passengers on footway and railroad in 1885 was 8,164,486 in excess of the previous year, or in total, 20,625,326 for the last year. The total revenue from tolls since the opening of the bridge on May 25, 1883, was $1,291,680.75, received from a total of 34,418,366 passengers to December 1, 1885.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY
BY
R. M. VAN ARSDALE,
MORSE BUILDING..... NEW YORK
Chicago Office, 175 Dearborn St., Room 10.

JAMES GILLET, ANGUS SINCLAIR, } *Editors.*

MARCH, 1886.

Subscription—$1.00 *a year for the United States and Canada; $1.50 a year to Foreign Countries embraced in Universal Postal Union*

EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock, construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

THE EXTENSION SMOKE-BOX.

Since it was first invented as a spark arrester for locomotives the extension smoke-box has had a rather checkered history. The urgent necessity for preventing locomotives from throwing sparks, which they are very liable to do, owing to the intense artificial draft used to produce steam rapidly, has led to many curious inventions, and few of them have had a more singular appearance than the extension front; yet through good and evil report it has gradually worked into favor, and it is doubtful if any spark-arresting invention has done its work more effectually and satisfactory than the extension front end.

Spark arresters, as usually designed, are mechanical contradictions. To make a locomotive boiler generate a great deal of steam in a very short time it is necessary to force the fire by strong artificial draft caused by the action of the exhaust steam passing rapidly through the smoke-stack. A multitude of devices have been tried to force the fire without using the exhaust steam for the purpose, but none of them came into the neighborhood of success. So it may be taken as an accepted fact that the exhaust steam is the only practicable means of creating the draft necessary to generate steam for a locomotive. The exhaust steam creates a vacuum in the smoke-box by its rapid passage through the smoke-stack, and also induces flow by friction on the air or gases it touches in its passage to the outer atmosphere. The obvious way to obtain the required draft with the lowest possible speed of the steam, which means the widest exhaust opening, is to give the steam and following gases free access to the atmosphere. But nearly all spark arresters have been so designed that they obstruct the flow of steam and gases before the latter emerge from the stack, and the consequence has been that the blast had to be sharpened to overcome the choking effect of the obstruction. Placing a cone or bonnet in the smoke-stack is analagous to planting a large bowlder in the middle and near the bottom of a mill race. No more difficult problem in physical investigation could be imagined than the task spark-arresting inventors undertook to perform. They tried to stop or check the gases of combustion in their passage, and yet maintain the speed, for a good draft meant a rapid flow. An immense amount of ingenious labor was devoted to catching the sparks, but attention was nearly always directed to the wrong end of the boiler. The proper place to arrest spark is in the fire-box where they belong, and where they will do good by making more heat instead of wasting it.

Recognizing the evils that arose from obstructing the smoke-stack, Mr. John Thompson, master mechanic of the Eastern Railroad, conceived the idea that by extending the smoke-box so that the cinders might pass beyond the line of draft, they would lie till removed. In 1860 he patented a spark arrester designed on this principle. He used no diaphragm to regulate the draft through the tubes, and no netting to prevent the sparks passing into the smoke-stack, and his invention proved a failure. The idea, however, obtained followers, and was regarded as a revelation in spark arresting. Within the next twenty years numerous improvements were invented, with the view of making the extension front a successful spark arrester. The change which the device made in the appearance of the engine was not kindly received by the conservative class so numerous in railway mechanical departments, and the invention was savagely assailed by many persons who knew nothing against it except its appearance. Numerous mistakes were made in attempting to put that form of spark arrester into use, and in many cases it was tried and rejected, tried again, and eventually adopted. Some of the best managed Eastern roads found the extension smoke-box a decided help in burning bituminous coal without annoying passengers with cinders and smoke, and they adhered to its use. It has gradually grown into favor, and is receiving increased application every day.

While this invention is certainly giving results superior to the diamond stack, or the able men who adopt it would not change, we believe that enlarging the cubic capacity of the smoke-box is a mistake, and that the advantages obtained from the extension smoke-box are due to causes not clearly recognized. Since it gives an uninterrupted flow of steam and gases through the stack, it appears very good compared to the vicious appliances it has superseded. The greater part of the sparks passing through the tubes being retained in the smoke-box, prompt indication is given if anything is wrong which causes an unusual amount of spark drawing. So the extension front cannot be used with any satisfaction unless it is used properly. We recently heard of a locomotive pulling a passenger train over a division 140 miles long, and the run was made easily without the smoke-box needing cleaning on the road. The engine did not steam so freely as the engineer liked, and he had the nozzles closed one-eighth inch. After this change, which would have been regarded as of no consequence with a diamond stack, the smoke-box had to be emptied twice before the end of the division was reached, and the engineer concluded he could get along with the large nozzles. Now, the loss of fuel represented by the extra sparks pulled through the tubes of that engine constituted a small portion of the heat wasted by employing contracted nozzles; but the waste would have passed unnoticed had the sparks retained not proved an inconvenience. The testimony that the extension front has furnished to many roads the enormous quantity of sparks drawn through the tubes has led to efforts at preventing the sparks from leaving the fire-box. We believe that the extension front will exert a valuable educational influence upon the men who handle locomotives, and upon those responsible for the waste of fuel, and that the training given will open the way to the use of ordinary smoke-boxes with stacks free from obstruction.

LOCOMOTIVE BOILER EXPLOSIONS.

No class of steam boilers largely used in America is so free from disastrous explosions as those used in our railroad locomotives, which is something remarkable in the presence of the fact that few boilers are run with a smaller safe margin of strength. Within the last few months there have been several locomotive boiler explosions that direct our attention to the subject, and we are the more disposed to discuss it, since attempts have been made to attribute one of the explosions to some mysterious cause beyond human comprehension. When a boiler explodes under a pressure which had often been carried before without signs of weakness, certain parties are sure to proclaim that some mysterious agency has been at work. In other departments of mechanical engineering, similar phenomena are of daily occurrence and pass without comment. A link in the chain of a crane breaks under a lighter load than the chain lifted two hours before, a crank axle breaks, not when the engine is working at its maximum power, but under comparatively light duty, a locomotive axle breaks when the engine is jogging along at a quarter the speed it made the day before. Every intelligent engineer meets incidents of this kind every month, and knows how to account for their occurrence. The same laws apply to the rupture of a steam boiler that control the safety of a chain link, yet the men who readily perceive a rational cause for a chain breaking today under a lighter load than it carried yesterday, fail to account in a natural way for a boiler exploding under ordinary working pressure and without warning.

No subject connected with the locomotive has received more careful attention from the Railway Master Mechanics' Association than the cause of boiler explosions, and the deliberate conclusion reached after years of patient investigation was, that ordinary over-pressure alone caused boilers to explode. A boiler works along safely for months or years after being built or thoroughly repaired, and some deteriorating agent keeps operating upon it unnoticed till a weak link in the shape of a corroded sheet or some broken stay-bolts gives way, and the boiler goes to pieces.

It is satisfactory to notice that the labors of the various Master Mechanics' Committees on boilers appear to have produced good results; for although the number of locomotives in the United States has been increased materially since 1875, the number of boiler explosions reported has been greatly diminished. During the year 1875, there were reports made of 26 violent explosions of locomotive boilers, and in 1885 the number reported was 11. This gratifying improvement is, no doubt, due to greater care and skill in designing, to better material used in construction, to more careful workmanship, and to the growing practice of rigid tests and searching inspection. This has been the line of policy advocated by the Master Mechanics' Association as the proper means for making locomotive boilers as safe as human agency can make a vessel containing the potential destructive agencies inside a high pressure boiler, and the men who enforce

this policy in their daily practice are the men who secure immunity from accidents. The safety of locomotive boilers, even those that have been well made of proper material, is secured only by the constant care and unremitting vigilance that will be sufficient to guard against and detect in time, deteriorating influences. When these are relaxed for any length of time, disaster is inevitable.

TIMBER FOR CAR BUILDING.

The effect of the increased activity in car building upon the prices of lumber used for sills is significant as an indication of a future scarcity and a permanent advance in prices. It is true, that during the past three years railroads have, as a matter of economy, made their old car equipment last as long as possible without incurring the expense of renewals. The time, however, has now come when the old stock must be replenished to meet the requirements of existing traffic, to say nothing of any prospective increase of traffic which is likely to attend a general revival in business. The simultaneous demand for new cars for a large number of roads that have been starving their stock may give a stimulus to the lumber market that may turn out to be merely temporary, to be followed by easier prices as soon as the stocks at the yards shall be increased to meet the demand.

This, however, remains to be seen. Certain it is that the sources of supply of the most desirable timber in the construction of cars are not becoming more abundant or nearer the points of consumption. White oak was once considered indispensable for sills, truck frames, and any part of a car exposed to severe strains, but its growing scarcity and the demand for it in other lines of construction have led to the use of Norway and Southern yellow pine, of which there is a more abundant supply at less cost. These timbers have of late years been extensively used for freight car sills of every kind, especially at the South, and stand the test for service, except for end-sills, practically as well as oak. Southern pine that has not had its strength and solidity impaired by tapping, is very stiff and durable. The further south it grows the more resinous, heavy and serviceable it is, and along with Norway pine is likely to be a staple material for car sills as long as the supply lasts and prices are not prohibitive. But even should the increased cost exceed the limits of economy, as it probably will in the course of time, there are other woods as yet but little used in car work that will become available. Spruce has already been tried, and if the testimony in its favor is reliable, it makes excellent sills. Hickory, also, is highly spoken of by those who have used it, and there may be other woods, as yet untried, that may be found equally well adapted to the purpose.

Furthermore, there is no telling to what extent timber-preserving processes may be developed under the spur of economy. Chemical treatment, it is true, might not add very much to the strength of a sill to resist strains, but moisture might be excluded and decay and rot prevented, which would, of course prolong the service. Paint is now relied upon to do this, and would do it more effectually than it does if it was applied more frequently and thoroughly.

As a last resource, when the forests shall be thinned to the point of extinction, we shall have the ore beds and smelting furnaces to fall back upon, and iron cars will at last become a necessity, their cheapness and durability will be recognized, and the weary waiting of their many sanguine advocates abundantly rewarded. But we are sorry to say that both cars and advocates must bide their time, which is not yet.

STREET CAR STARTERS.

The statement has been made that some 2,500 patents have been issued in the United States for street car starters. If this is so, it is no wonder that the patent office has become a source of revenue and pays a surplus of several hundred thousand dollars every year into the treasury. It is safe to say that any practicable car-starting device will continue to be the one thing needful in street car propulsion so long as horse power holds its own against mechanical motors. Inventors have been wrestling fruitlessly with the problem for years, and although the field still remains clear, and is growing larger every day, very little has as yet been accomplished in the way of supplying the "long-felt want." To say that the problem is beset with difficulties makes it none the less, but all the more, fascinating to a large number of inventors who are eager to reap the rich harvest of success.

But after all, is there not some delusion about it akin to that of perpetual motion? We are inclined to think there is. Indeed, we are quite sure of it, so far as storing up the momentum energy of the moving car is concerned and making it available for starting. It involves a question of compensation very much like that which is involved in lifting one's self by one's boot straps, or in making something out of nothing, only its absurdity is less apparent. The power expended in checking the momentum is something, to be sure, and it really seems as if this energy could be applied in winding up a spring or in compressing air into a cylinder, and that the power thus caught and harnessed could help start the car. And so it can be, but there isn't enough of it. The game don't pay for the ammunition. The average street car speed is too slow, the momentum energy is too little, and besides, it is not all stored up, a large percentage of it being frittered away and lost in the slow stopping. The available excess is consequently too small to compensate for the cost of apparatus and the energy expended in hauling the additional weight. A helper in starting is needed most in ascending grades, and on these the momentum power is diminished in proportion to the steepness of grade, while on the heavier grades, where a horse-helper has to be used, it is practically nothing.

A street car can never be made to start itself except down an incline, but the toiling inventors are trying to devise a plan to make it help start itself on a level, with a load of passengers and the additional weight of a mechanical starting apparatus. If the requisite power for doing this could be supplied extraneously from the terminals or at points along the line, and the quantity needed could be boxed up, taken on board and used at every stop, it would be about the thing that is wanted, but the ways and means for doing this are yet to be discovered.

THE Pennsylvania Railroad Co. has organized a Relief Department for the benefit of its employés, the general details of which are set forth in an official circular recently issued by the company. The plan embodies a system of insurance at specified rates according to grades and salaries, for the benefit of employés disabled by sickness or by injuries received in the service of the road. Provision is also made for extending the benefits to relatives of deceased employés.

The scheme exhibits upon its face a commendable solicitude on the part of the company for the welfare of its servants, but when closely scrutinized it is found to contain some objectionable features which must prevent its ready acceptance by the beneficiaries. In its general scope it is a little too suggestive of the Pullman mode of taking care of people, its requirements are too rigidly paternal, there are too many carefully worded safeguards for the protection of the company, and the freedom of action of the participants in the proposed relief is too palpably ignored. None of the present employés are required to become members of the fund, but all persons entering the service of the road, and present employés who shall be promoted after the relief department is organized, are required to participate in its benefits, and must submit to have the prescribed rates withheld from their wages. In other words, these persons must buy their insurance of the company as a condition of service or promotion, although they may prefer to buy it elsewhere, or to take the risk of no insurance. This is compulsion, or a forced choice between complying with the prescribed conditions or not entering the service.

There are some other questionable features in the plan which have been made the subjects of adverse criticism. It remains to be seen to what extent the scheme will prove successful. At present the disposition of the employés to participate in the benefits does not seem to be universal.

IN another column we publish some of the instructions of the mechanical department of the Pennsylvania Railroad Company regarding the inspection and sampling of material for the use of the road. This company have followed the system of inspecting material so long, and performed the work so thoroughly, that they have gradually become authority on the proper tests for ascertaining the value of material, and many people have even come to confound the Pennsylvania tests with something authoritatively established by the railroad mechanical associations for the guidance of dealers. We recently heard parties interested in car-building talking of the Master Car-Builders' tests for axles in a way which indicated they meant the Pennsylvania Railroad tests, so we publish particulars of the latter tests for the benefit of all concerned.

Ealy's "Blue Book" of Special Credits: January, 1886. The current number of this publication is very greatly enlarged as compared with the size of its predecessors, the pages being 12¾ by 8¾ inches, exclusive of margin, and containing the names and ratings of over 300,000 merchants, manufacturers and dealers in Hardware, Iron, Machinery, Agricultural Instruments, Railway Machinists', Engine and Boiler Makers' Supplies, the Workers in Iron and other Metals, and kindred branches of trade in the United States and Canada. In its general arrangement the volume is similar to Bradstreet's reports, but less cumbersome and far more reliable, for the reason that it is limited to the particular classes or branches of trade indicated. The information furnished is more precise in its details, and leaves much less to inference than is the case with other systems based upon the idea that capital is the only criterion of credit. The "key" to which reference is made in connection with nearly every name, includes 126 different specifications, covering as near as may be everything pertaining to a business, its management and condition, and the usages, practices, business methods and qualifications of the party or parties conducting it, enabling the seeker for information to discriminate between small capital with good credit, and large capital with poor credit. Within its scope and range, it is the best and most reliable work of the kind ever published, and there can be no better evidence of its usefulness and sterling merits than its steady growth and improvement since the initial volume appeared eight years ago. Published in January and July by the John W. Ealy Co., New York and Chicago.

Railway Master Mechanics' Association Annual Report: The report of proceedings of the eighteenth annual Convention of the American Railway Master Mechanics' Association has been received. Mechanically the report reaches its usual excellence, and reflects the greatest credit upon the painstaking care of the able Secretary, Mr. J. H. Setchel. Our readers were kept well informed of the proceedings of the Convention at the time it was held, but those who wish to read the detailed discussions on the subjects investigated, will find the report very full and accurate. We consider the matter contained in the annual reports of the Master Mechanics' Convention the most valuable of any technical society's proceedings, and the report for 1885 will compare favorably with anything that has preceded it.

The Wanderer is the title of a spicy and highly interesting monthly paper started on the first of this year to represent the interests of the Milwaukee Central Railroad. The leading aim of the paper is to make known the attractions of the road as a line of travel, and the purpose is admirably worked out. We even heard that a group of Chicago drummers were so fascinated with the pictures in the first number illustrating the winter attractions of Northern Wisconsin as a winter resort, that they started off in a body to sell goods to the pleasure-seekers that crowd these regions, and that the last heard from them was that they had gone through some thrilling bear-hunting experience. *The Wanderer* is edited by Mr. Frank L. Crosby, who evidently knows how to mix interesting reading matter with railroad business.

Railway Life is the name of a new paper just started at Toronto, Ont. It is published weekly, and is intended by its projectors to be a distinctive representative of Canadian railway interests, a field in class journalism that has hitherto been unoccupied. The initial number contains several brief but well written editorials, and an interesting variety of miscellaneous matter pertaining to current railway topics. As a local medium of information for the numerous grades of officials and employés of the roads in the Dominion, the new journal is deserving of a prosperous future. It contains 16 three column pages, 10½ × 7 inches, exclusive of margin, and is handsomely printed. T. S. Norris, Editor; W. B. Campbell, Manager.

We have received copies of the *Engineering Era and National Contract Inspector*, another journal asking for public patronage. The paper is a semi-monthly, and is published in Cleveland, O. It is filled principally with matter pertaining to civil and electrical engineering, the greater part being very judiciously selected. The paper is very readable and looks as if it would succeed.

THE death of Mr. F. W. Richardson, which occurred at Troy, N. Y., Jan. 19, was a shock and surprise to his many friends. He was but little more than thirty years of age. Inheriting an aptitude for mechanics, he learned the trade of machinist at an early age. He was at one time connected with the lighthouse and fog signal department of the Government, but subsequently engaged in the machine business at Troy. He had an extended acquaintance with railroad men, among whom he was known chiefly in connection with the successful introduction of his balanced slide-valves in locomotive practice.

IN the patent suit of A. B. Stone vs. Elliot Frog & Switch Co. for alleged infringement of a patent on a railway switch issued to Clarke, Jeffreys & Stewart in 1874, decision was rendered for defendant some weeks ago. Complainant moved to have the decree set aside and for a rehearing, which motion has been overruled by Judge Treat of the United States Court.

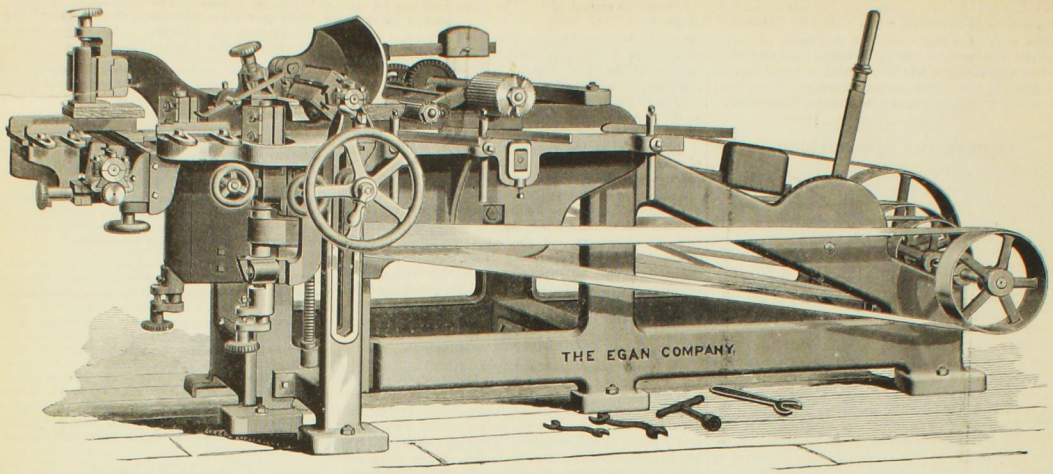
BYRAM & CO. (Iron Works), Detroit, Mich., have just shipped one of their furnaces to the Cooke Locomotive & Machine Works at Paterson, N. J.

GARDNER & CO. (successors to Gardner, Holmes & Co., and manufacturers of perforated veneer seating and ceilings) have removed their salesroom from 183 to 206 Canal street, corner of Mulberry, New York.

THE Boston & Lowell road has been trying a new arrangement for ventilating cars, the invention of William Ober, of Salem, Mass. By his arrangement a fan is driven from one of the car axles; this forces the air through water to relieve it of dirt, when it passes along the car in a duct, and up and into the car through small pipes reaching above the tops of the seats. The tops of these pipes are provided with flaring mouth-pieces which may be turned in any direction, or any of the pipes may be closed entirely.

How to Advertise.

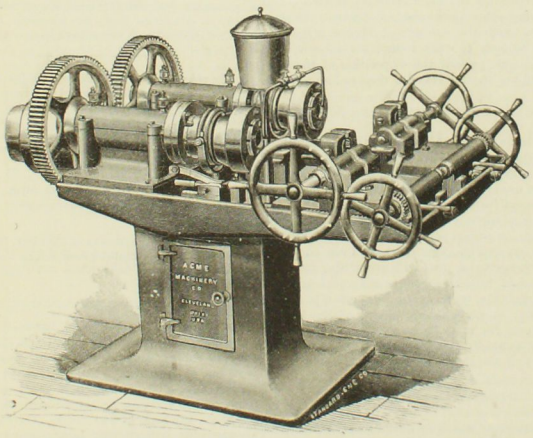
An exchange, in some "hints on advertising," says: "Another thing which publishers have to contend with is that the results of advertising are not always visible to patrons, many of whom cannot understand why custom cannot be directly traced to the source where they expended their money to obtain it. Business is like a river with many tributaries, and in which it is impossible to trace every individual drop of water to the spring from whence it came. But if a journal is selected for advertising purposes that reaches time and again the persons most likely to be interested in the solicitation, that paper is certainly a sure founta n-head of profitable trade in the stream of patronage far below. Temporary advertisements in a small way will not produce an immediate or permanent increase of business any more than a light shower will affect the depth of water in a well, but by persistency in the use of printer's ink in the right direction the results sought will be gained in the end with interest."



NEW TEN-INCH FOUR-SIDED MOLDING MACHINE.

THE engraving represents a newly designed four-sided molding machine just brought out by the Egan Company, Cincinnati, O. The frame is very heavy and well braced, and is made extra long so that the belts have great pulling capacity, and every advantage and clearance for easy running. The main spindle is of best cast steel, and has three very long bearings. The boxes are self-oiling, and are lined with genuine nickel Babbitt metal. The patent outside bearing is of the latest improved construction; it goes to the floor and is braced by a solid projection from base of frame. No bolts or outside boxes have to be taken off to raise the lower bed. The side heads with their spindles raise and lower with table, and both inside and outside spindles are adjustable while in operation by hand wheels on the front side. The under head is all adjustable laterally. This is a great improvement and advance on moulders, and will be appreciated by all first-class operators. There are chip breakers to every head, and in this there is a marked excellence, as there can be no tearing on any of the heads the way these improvements are rigged.

The feed is extra powerful, and consists of two rolls above and one in the bed, all geared in a superior manner, and the expansion for driving lower roller is so perfect that the bed can be lowered 16 inches and the feed remains just as powerful. There are two feeds on the machine. The upper feed spindles are hung on links in such a manner that the feed rollers raise up parallel, giving the fluted roller a full bearing on board the entire width of piece. By an improved system of weighting, the feed rolls can be instantly raised up, allowing the operator to slip the board back.



Acme 1½ Inch "Straight Line" Automatic Double Bolt Cutter.

This machine was designed for Railroads and Car Shops where perfect threads are required to be cut in large quantities. The pan and column are one casting, and is so shaped that as the oil or alkali water leaves the dies it drains down into the column from where it is again pumped up into the reservoir, as shown in cut. This reservoir has a drain pipe in it, so when it is three parts full it flows back into the column again. A plunger pump is located inside the column. The automatic motion is very simple, consisting of a steel rod passing through the carriage and secured to a steel fork which operates the thread and dies, hence it is called a "Straight Line" automatic. When the bolt has been threaded the desired distance, the dies open automatically, and as the carriage is drawn back the dies are closed again by the same motion, which makes this really automatic both ways in opening and closing. It is made of the very best material and workmanship, and is manufactured by the Acme Machine Co., of Cleveland, Ohio.

MR. C. F. WHITNEY, Boston, Mass., manufactures some special soaps adapted to cleaning cars. These soaps are in the form of bars or liquid, and remove dirt without injury to paint or varnish, leaving the surface of the car in perfect condition for revarnishing when necessary. It is the cheapest and most effective car cleaner in the market.

THE Pittsburgh, Pa., Bessemer Steel Co., Limited, has been dissolved by mutual consent, the business having been purchased by an association under the name and style of Carnegie, Phipps & Co., Limited.

CLEVELAND, O., February 3, 1886.

The business of the Winslow Car Roofing Co., has this day been sold to the Paige Car Wheel Company, who will continue the same at the old office, No. 211 Superior street, Cleveland, O.

The Winslow Car Roofing Co., take this opportunity to extend its thanks to the railroad companies and car builders who have been its patrons for the last 18 years, and hope they will continue business with its successors. By order of the directors.

W. S. DODGE, Secretary.

OFFICE OF PAIGE CAR WHEEL CO.,
CLEVELAND, O., Feb. 3, 1886.

Referring to the above notice would say that we are prepared to fill all orders promptly for the above well-known car roof, and trust that we may be favored with your orders. Very respectfully,

PAIGE CAR WHEEL CO.

J. E. FRENCH, President.

THE PEERLESS MANUFACTURING CO., of Louisville, Ky., have purchased the property formerly occupied by the Louisville Agricultural Works, consisting of a three-story building, and foundry and machinery in working order. The increasing demand for the Rice Sand Molding Machine, illustrated in our September issue, has compelled the company to greatly enlarge its capacity for their manufacture. The company will move into its new quarters at once.

THE PATENT SHAFT & AXLETREE CO., of Wednesbury, England, represented in the United States by W. R. Ellis (New York and Boston), have made arrangements with Krajewski & Pesant, proprietors of the Erie Basin Iron Works, South Brooklyn, N. Y., to put together their wrought-iron wheels, the centers of which are imported, with any kind of steel tire that may be desired.

THE ACME MACHINERY CO., of Cleveland, O., have sold two of their Straight Line Automatic Double Bolt Cutting machines to the Peninsular Car Co.; one to the Evansville & Terre Haute R. R.; one to the Cleveland City Forge & Iron Co.; one to Aultman Co., of Canton, O., and several others. The company employ 32 men on bolt cutting alone, are putting in new machinery, and contemplate enlarging their works this spring.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge or of any errors that may be noticed in our list:

Burlington, Cedar Rapids & Northern.—George A. Goodell has been appointed Assistant Superintendent of the Second, Third and Fourth Divisions, vice J. C. Fox, resigned. W. F. Ward succeeds Mr. Goodell as Superintendent of Telegraph and Train Dispatcher.

Chicago, Burlington & Northern.—David Coleman has been appointed Superintendent, and C. A. Goodnow Assistant Superintendent, of Northern Division, and J. M. Barr Assistant Superintendent of Southern Division.

Chicago & Northwestern.—W. B. Linsley has been appointed Superintendent of the Peninsula Division, vice W. F. Fitch, resigned.

Cleveland & Canton.—Samuel Briggs has resigned the position of General Manager.

East Tennessee, Virginia & Georgia.—E. H. Barnes has been appointed Superintendent of the Georgia Division, vice J. W. Fry, who has gone to the Mobile & Ohio.

Galveston, Sabine & St. Louis.—John M. Duncan has been appointed Receiver and C. W. Booth General Manager.

Housatonic.—Henry A. Bishop has been appointed Superintendent. He has been for some time on the Naugatuck road.

Jacksonville, Tampa & Key West.—The Jacksonville, St. Augustine & Halifax has become a part of this road, and will be known as the St. Augustine Division, W. L. Crawford Superintendent, and W. S. Sneden is Superintendent of the Indian River Division, heretofore the Atlantic Coast, St. Johns & Indian River road. M. R. Moran is General Superintendent of the Jacksonville, Tampa & Key West Railway system.

Missouri Pacific.—T. W. Newell has been appointed Master Mechanic of the Missouri, Kansas & Texas Railway and branches, vice W. F. Smith, resigned.

Mobile & Ohio.—J. W. Fry has been appointed Superintendent of Southern Division.

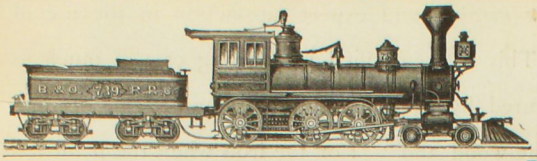
New York, Lake Erie & Western.—W. J. Murphy is relieved from the charge of the Rochester Division, but continues Superintendent of the Buffalo Division. Mr. G. W. Bartlett is appointed Superintendent of the Rochester Division.

New York, Ontario & Western.—J. E. Childs, heretofore General Superintendent of this road, has been appointed General Manager.

St. Louis, Arkansas & Texas.—This company is the successor of the Texas & St. Louis in Texas.

Employment.

WANTED.—By a first-class draftsman and practical car-builder, a situation in a railroad car-shop, as draftsman or in some other capacity. The advertiser is well acquainted with the construction of sleeping cars, ordinary coaches and other cars; has had long experience, and can furnish the best recommendations. Is a married man. Address F. H. G., office of the NATIONAL CAR-BUILDER.



PITTSBURGH LOCOMOTIVE AND CAR WORKS,

PITTSBURGH, PA.

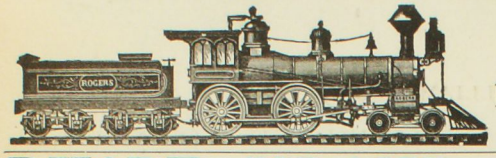
MANUFACTURERS OF

Locomotive Engines for Broad or Narrow Gauge Roads,

From standard designs, or according to specifications, to suit purchasers.

Tanks, Locomotive or Stationary Boilers Furnished at Short Notice

D. A. Stewart, Prest. D. A. Wightman, Supt. Wilson Miller, Sec. & Treas.



ROGERS LOCOMOTIVE AND MACHINE WORKS,

PATERSON, N. J.

New York Office, 44 Exchange Place.

Manufacturers of Locomotive Engines and Tenders and other Railroad Machinery

J. S. ROGERS, President. R. S. HUGHES, Secretary. WM. S. HUDSON, Sup't. } PATERSON, N. J.

R. S. HUGHES, Treas., 44 Exchange Place, New York.

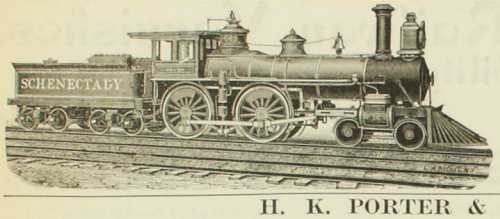
RHODE ISLAND LOCOMOTIVE WORKS,

PROVIDENCE, RHODE ISLAND.

EARL PHILIP MASON, Vice-President. WILLIAM P. CHAPIN, Treasurer.

CHARLES FELIX MASON, President. JOSEPH LYTHGOE, Superintendent.

ARTHUR LIVINGSTON MASON, Secretary. WILLIAM H. FENNER, Jr., Agent.

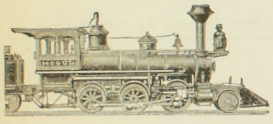


SCHENECTADY LOCOMOTIVE WORKS.

CHAS. G. ELLIS, President. WALTER McQUEEN, Vice-President.

EDWARD ELLIS, Treasurer. A. J. PITKIN, Superintendent.

SCHENECTADY, N. Y.



H. K. PORTER & CO.,

PITTSBURGH, PA.

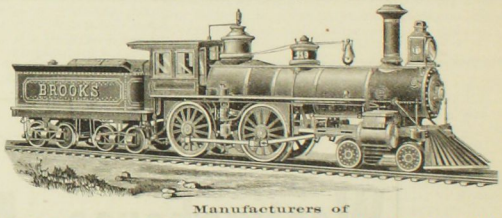
LIGHT LOCOMOTIVES.

All work steel-fitted and interchangeable. Duplicate parts kept in stock.

Illustrated Catalogue mailed on application.

BROOKS LOCOMOTIVE WORKS

DUNKIRK, N. Y., U. S. A.



Manufacturers of

ALL CLASSES OF LOCOMOTIVES AND THE THURBER STEEL WHEEL.

H. G. BROOKS, President. M. L. HINMAN, Sec'y and Treas'r.

J. H. SETCHEL, Sup't. R. J. GROSS, Traveling Agent.

THE ASHTON NOISELESS BLOW-BACK VALVE

Silent Relief to Locomotives.

Waste Steam used to heat Feed Water.

Restrains the use of Shovel.

Large Economy of Fuel.

Our Open-Pop Valve has an unrivaled reputation.

THE ASHTON VALVE CO., 271 Franklin St., Boston, Mass.

Railroad Journal Bearings

BRASS CASTINGS.

BABBITT METAL.

SOLDERS.

DEALERS IN

All Kinds of Metals.

J. J. RYAN & CO.,

62 & 64 West Monroe Street, Chicago

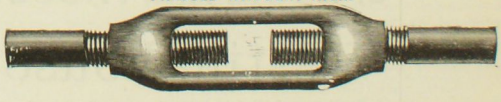
OCEANIC Steam Laundry COMPANY.

RAILROAD, STEAMSHIP, HOTEL AND RESTAURANT WORK.

630 GRAND AND 32 to 38 BISHOP STREETS,

CHAS. ZUST, Manager. JERSEY CITY, N. J. TELEPHONE CALL 214.

PRESSED WROUGHT IRON.



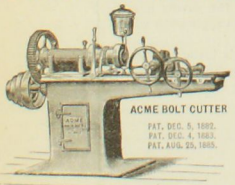
Made by

CLEVELAND CITY FORGE & IRON CO.,

Cleveland, Ohio.

ACME MACHINERY COMPANY,

CLEVELAND, OHIO.



Advantages of the "Acme" Bolt Cutter.

Large bearing on top of Dies by using a Cap. Fine adjustment by differential screw. Positive Toggle Lock. Die-ring connected to barrel. Positive Motion. Every part exposed to view. It cannot clog with chips or scale. Quickness of changing Dies (in less than a minute). No springs used. Index on Head so a fit can be cut at once. Cheapness of Dies, advantage of Plain and not the disadvantage of Case Dies. Reversible Dies. Even number of Dies and ahead of center. All wearing parts are tempered Steel, made to Jigs and Standard Gages, and are interchangeable. Dies cut in one Head will fit any other, and where more than one Head is used this is a very vital point. *The ACME Head can be put on almost any Bolt Cutters, and parties having other make of machines will find a great improvement by putting an "ACME" Head and Dies on it.*

EWALD IRON COMPANY,

OWNERS AND OPERATORS OF

—TENNESSEE ROLLING WORKS.—

Tennessee Charcoal Bloom Boiler Plate, Flange, Fire Box, Sheet, Bar and Stay-Bolt Iron.

ST. LOUIS OFFICE, - - - - 801 NORTH SECOND STREET.

MANUFACTURE CHARCOAL IRON EXCLUSIVELY.